SCIENCE AND INDUSTRY

December, 1947

THE JOURNAL OF GLASS MANUFACTURING

DEC 13 1947

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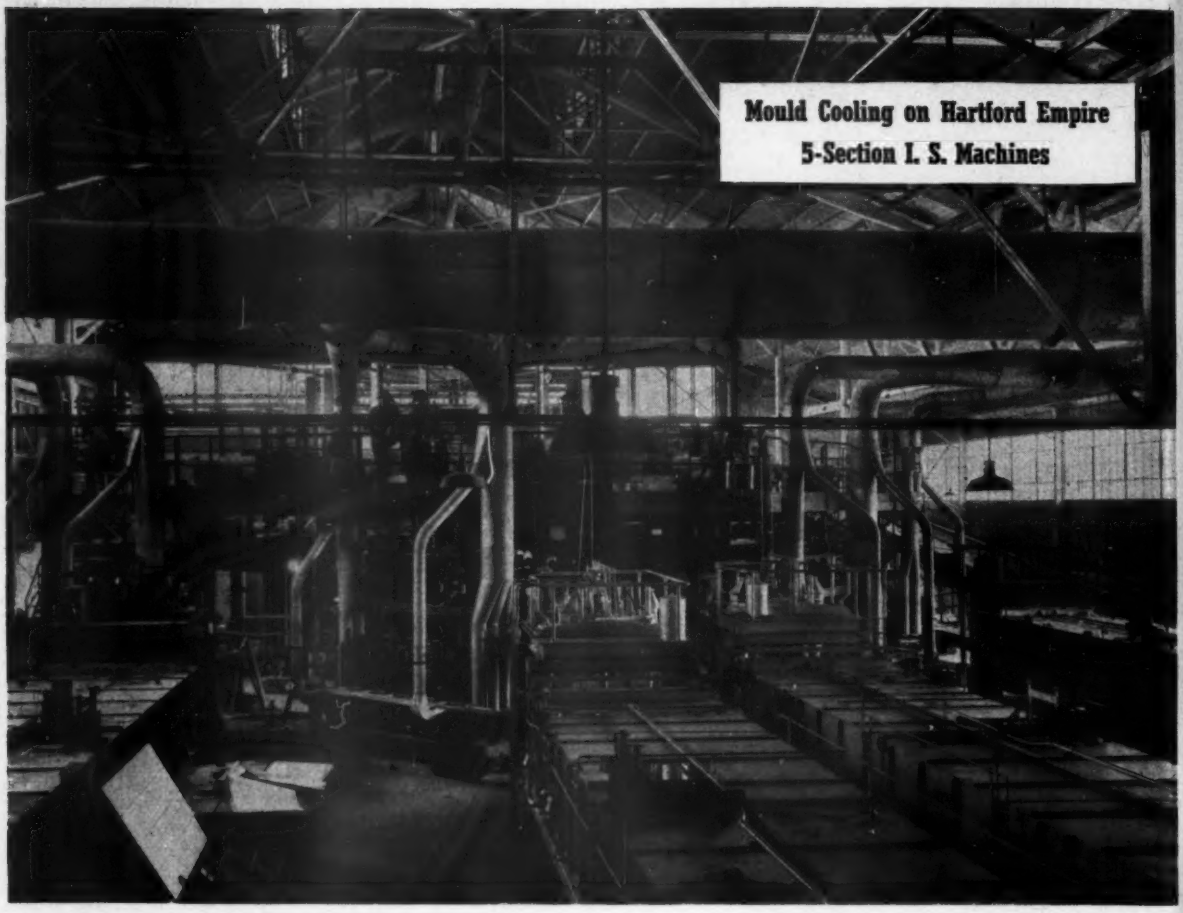
the glass industry

STACKS

REFERENCE
DO NOT LOAN

The marble forming opera- at Glass Fibers, Inc. Glass es from the forehearth in a ten stream, is sheared off in- small pellets which are then d into marbles between re- ing spiral shafts.

No. 12



Over 7 million extra bottles per year with KIRK & BLUM mould cooling system

reports Brockway Glass Company*

THE M-2 CAST ALUMINUM NOZZLE

Furnace production and life boosted too! Maintenance and repair costs at new low.

*This is from a certified report, released by an independent research organization.

Quote: "Our experience with Kirk & Blum furnace and forming machine cooling systems has been a long and very satisfactory one.

"On our 1940 furnace cooling installation, we find that maintenance and repairs with no new parts required, have been kept down to $1.50 per week. The cooling system extended the life of the furnace about 15% . . . a saving of $7,150.00.

"On one set of forming machines we are bettering the industry's average, shown in the Hartford monthly reports by 25%.

"Our record of repeated Kirk & Blum installations shows our recognition of the efficiency of this equipment in increasing production." End quote.

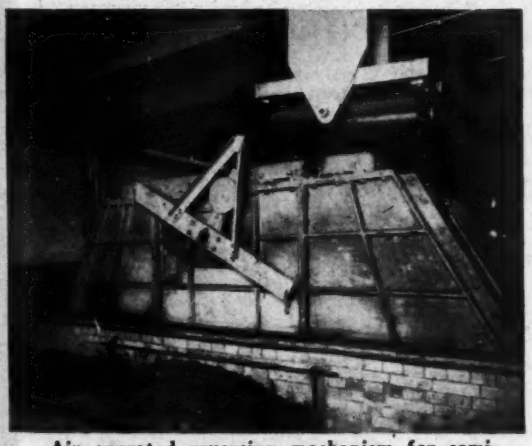
And there's not much that we can add to that, outside of mentioning that typical furnace and glass moulding cooling systems are illustrated in a New Kirk & Blum Glass Industry Booklet. Write for your copy now. The Kirk & Blum Mfg. Company, 2804 Spring Grove Ave., Cincinnati 25, Ohio.

KIRK AND BLUM ...ENGINEERED COOLING SYSTEMS

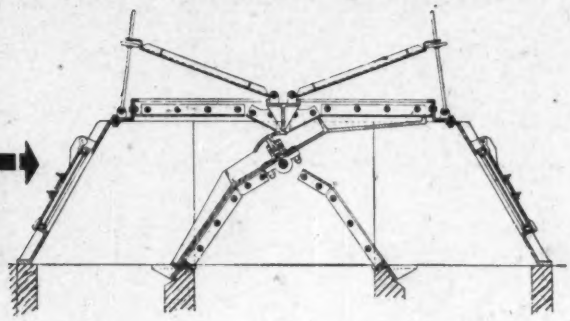
FOR THE GLASS INDUSTRY

with a SIMPLEX Air Reversing Valve

The instrument panel which contains the Push Button Control, Timing Device, and a set of Indicating Lights to indicate on which side of the furnace the air is being introduced. A motorized reversing mechanism for fully automatic reversals.



Air operated reversing mechanism for semi-automatic reversals.



Over a hundred Simplex Air Valves in service on glass melting furnaces of all types and sizes.

Durable cast iron construction of good design . . . with a size and price to suit the operation.

Can be equipped with a fan to supply combustion air effectively where stack or checker height is inadequate.

Compare these advantages—

- No water cooling required . . . lower maintenance.
- Maximum air intake with minimum friction loss.
- Accurate control to balance air intake to each regenerator.

FRAZIER-SIMPLEX, INC.
Engineers
428 EAST BEAU ST.—WASHINGTON, PENNA.

Tank Furnaces • Batch Chargers • Batch Handling Systems • Producer Gas Plants • Decorating and Annealing Lehrs • Stackers • Complete Plants

AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATI

the glass industry

CONTENTS FOR DECEMBER : 1947

Glass Fibers, Inc., Swings into Full Production ... ...

Among other modern applications in the new plant, high frequency heat is employed for the first time in fibrous glass manufacture. By Frank E. Butler.

G.C.M.I. Holds Semi-Annual Meeting in Miami ... ...

Nine Standing Committees present reports to the Trustees during three-day meeting.

Effect of Coloring Oxide Additions on the Spectral Transmission of a Soda-Lime-Silica Glass ... ...

A paper dealing with a systematic investigation concerning the effect on spectral transmission of the addition of coloring oxides to base glass of composition similar to that of most commercial glasses. By George S. Bachman.

Annual Meeting of the Optical Society ... ...

Several items of interest to the glass technologist were presented at the annual Optical Society Meeting.

Reduction of Sodium Sulfate in Glass Manufacture ... ...

A translation from the Russian journal of the glass and ceramic industries outlining the effects of sodium sulfate on the glass and refractories.

Inventions and Inventors ... ...

Summary of Recently Issued Patents of Interest to the Glass Industry.

Research Digest ... ...

Practical Interpretations of Glass Technology.

Current Statistical Position of Glass ... ...

Production, Shipments and Employment for the months of September and October 1947.

New Equipment and Supplies ... ...

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P. B. Sillimanite Crowns

"BALANCE" FURNACE CONSTRUCTION

a new use for a Proven Refractory

The photograph shows the excellent condition of a P. B. Sillimanite melter crown and rear wall after two fires—a total of 458 days of service. P. B. Sillimanite-Special Grade brick used for the crown, 12" thick and bonded with trowelled joints of P. B. Sillimanite #301 Cement. The entire crown and the breast walls are insulated with 2½" of high temperature insulating brick and the original crown and rear wall are still in service. This is an End Fired tank, melting special glasses.

A portion of the refiner crown was built of another special refractory, similar to P. B. Sillimanite. This section is failing due to shrinkage, dripping and spalling.

INSULATED CROWNS . . . P. B. Sillimanite special refractories are recommended for the crowns of furnaces which are used for melting boro-silicate, dense opal and similar glasses where the conditions are just too 'tough' for silica or super-duty silica brick. In these cases, P. B. Sillimanite crowns may be insulated to help defray the high initial cost.

On furnaces where silica brick crowns are lasting from 2 to 3 fires it is highly improbable that higher priced, special refractories can be used economically. The savings made possible by the insulation of the crown are not sufficient to return the investment in special refractories within a reasonable time.

Write today for more complete information on this and other interesting uses of P. B. Sillimanite in the construction of 'Balanced' glass melting furnaces.

CHAS. TAYLOR SONS Co.

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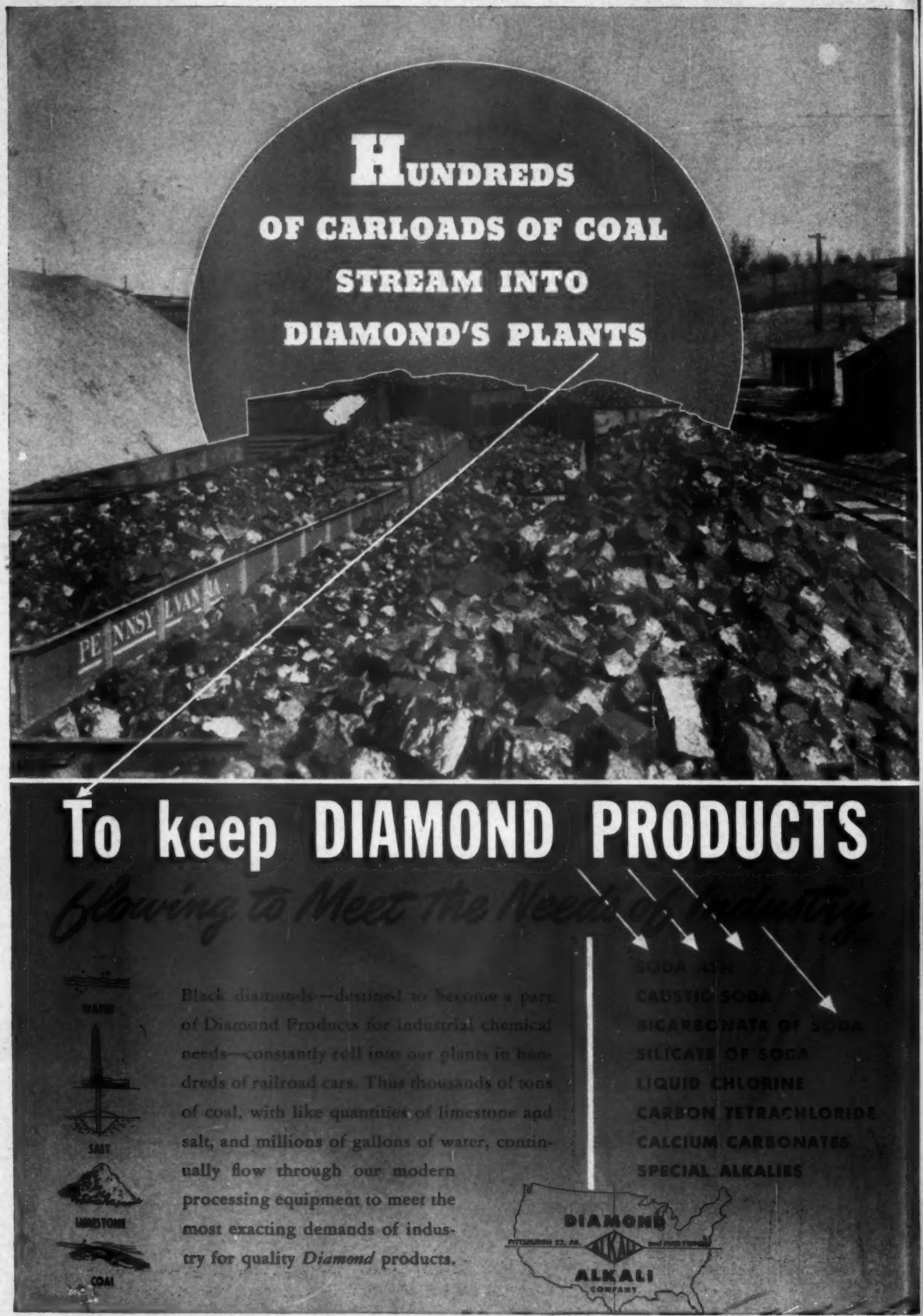
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OF CARLOADS OF COAL
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SILICATE OF SODA
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COMPANY

2 WAYS

to approach a color problem

. . . tint the air with hues and tints OR ask Drakenfeld to help

• When the atmosphere is heavy with experiments to find a way to solve a color problem, you end up in a mental whirl, work lags on other important jobs, and production schedules are upset.

For many years ceramic and glass manufacturers have been turning over their "color headaches" to Drakenfeld. There's a reason: whatever the particular requirement—whether a new color must be created or an old one matched—our technological staff goes to work with a will. Results have proved that their know-how can step up production, reduce rejects and produce better ware at greater profit. No wonder Drakenfeld colors, coloring chemicals and supplies are recognized for quality that satisfies the most exacting specifications.

We would like the opportunity of showing you how our color research facilities can help you get rid of "color headaches." Avail yourself of Drakenfeld's broad experience and friendly, cooperative service. Let us talk over your problems and requirements. Write us today.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Crystal Ices . . . Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Decorating Supplies.

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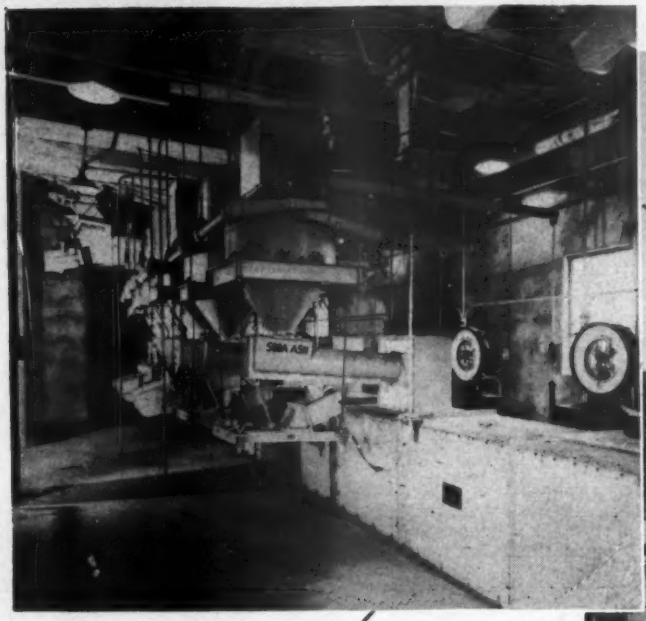
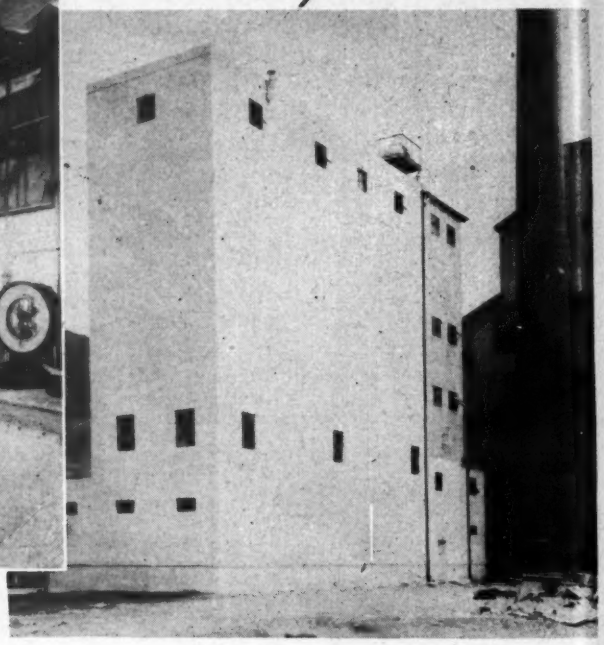
MODERN BATCH PLANTS

By FORTER-TEICHMANN CO.





For Quality Glass, Increased Production, and Low Fuel Consumption

Illustrated above are a Batch Plant and one section of the batch conveyor and weighing system designed and constructed by Forter-Teichmann Company. In this batch plant the cullet is uniformly crushed to the required measure, accurately weighed and mixed with other components by automatic action. The batch is then conveyed at a regulated and even rate and delivered with the minimum of foreign matter and with the correct consistency directly into the furnace. The entire process is controlled by push button operation, but provisions for manual operation are available throughout.

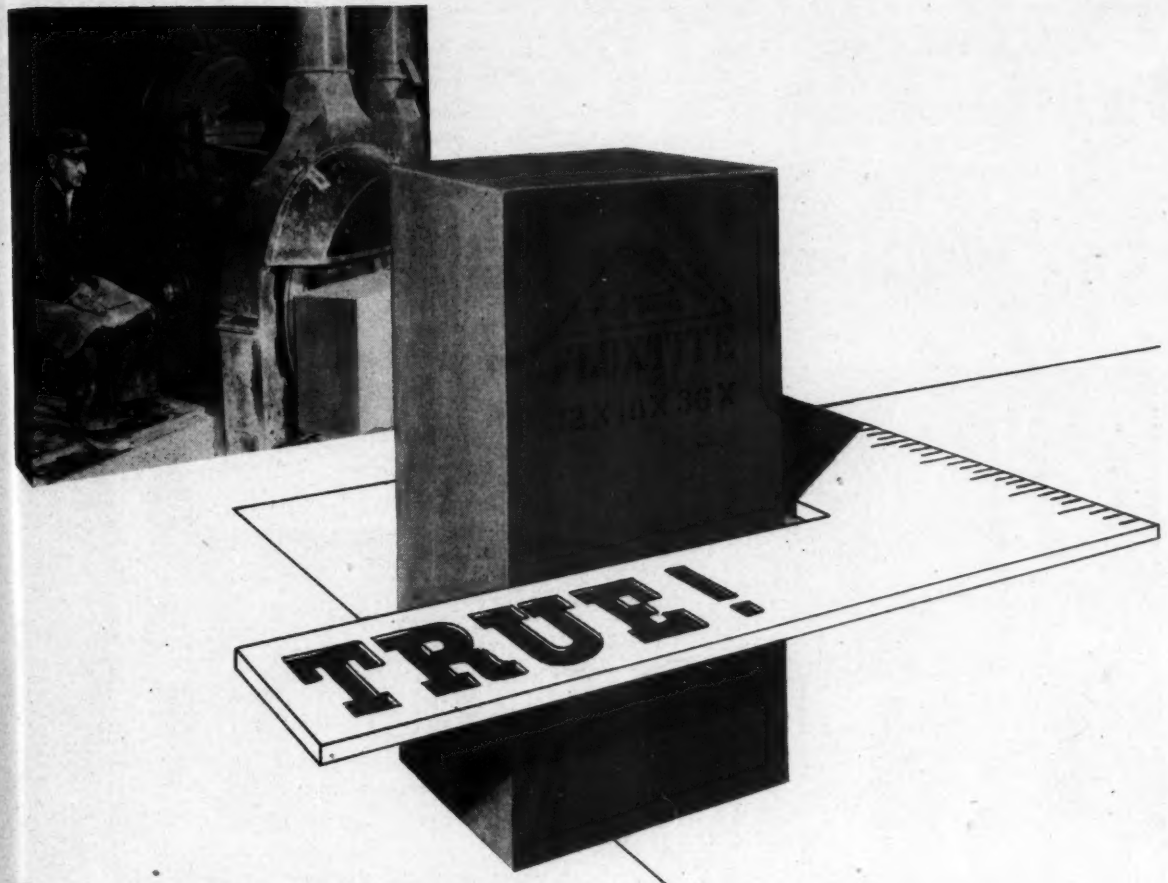
This modern and easier method of batch handling insures first quality glass, increased production, and lower fuel consumption.

Whatever your glass plant problems, consult Forter-Teichmann Company. We will be glad to study your particular requirements and submit our recommendations.

FORTER-TEICHMANN *company*

610 Smithfield Street **Pittsburgh, Penna.**

Cable "FORTER" *Associate: Forter-Teichmann International* **Phone GRant 1302**



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And **FLUXTITE'S** economy doesn't end with the installation. It keeps on saving you money month after month:

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In emergencies, shapes can be cut quickly by us or on the job

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precision-machined

Tank Blocks
cut your installation costs

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Ambassador Bldg., St. Louis 1, Missouri

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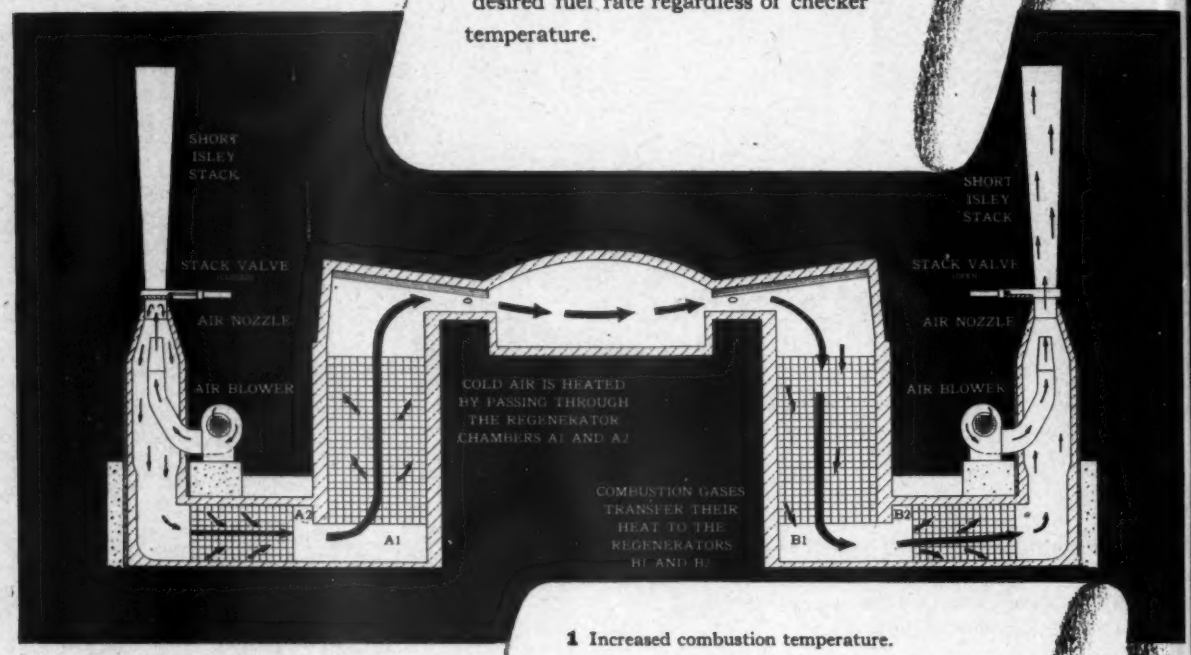
3 Furnish combustion air for the desired fuel rate regardless of checker temperature.



. . . and here are the Profits

1 Increased combustion temperature.

2 Increased rate of heat transfer.

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4 Prevention of excessive refractory repairs caused by excess pressure.

5 Maintaining the combustion efficiency throughout a campaign.

6 Any firing rate allowed at any time, regardless of furnace temperature or checker condition.

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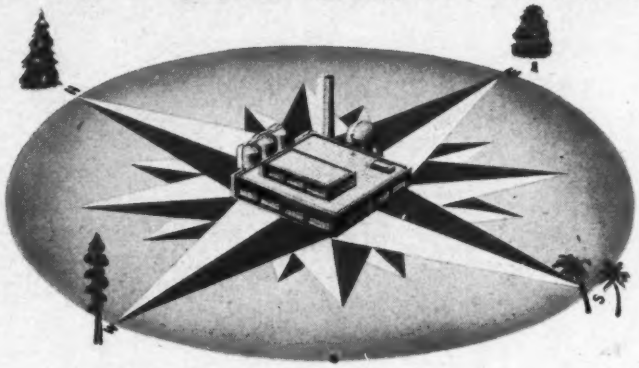
OUR PLANTS BLOOM THE YEAR 'ROUND

...IN YOUR BACK YARD!



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Glass Sand in abundance! Sand of proven quality —SiO_2 of 99.83%. Sand that has helped produce quality glass products for years. These sand deposits are also bordered by huge deposits of quality limestone and dolomite, and supplies of soda ash, borax and feldspar are close by.

But raw materials aren't the only advantage of locating your plant in Oklahoma. There are 14 large glass plants located here, tapping the potential nine billion dollar Southwestern market from the center. Production costs are lower—because of abundant and low cost natural gas, native coal, oil, ample electrical power. Oklahoma also has many fiber box factories and foundries to serve you. Labor? One of the lowest strike rates in the nation!

Investigate ALL the advantages of locating a glass plant in Oklahoma. Because "facts* prove," Oklahoma's "OK" for the glass industry.

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"Factors favoring business expansion in Oklahoma.". Interesting—Informative. Write for it—Now! Special confidential report relating to your business will be made if requested.

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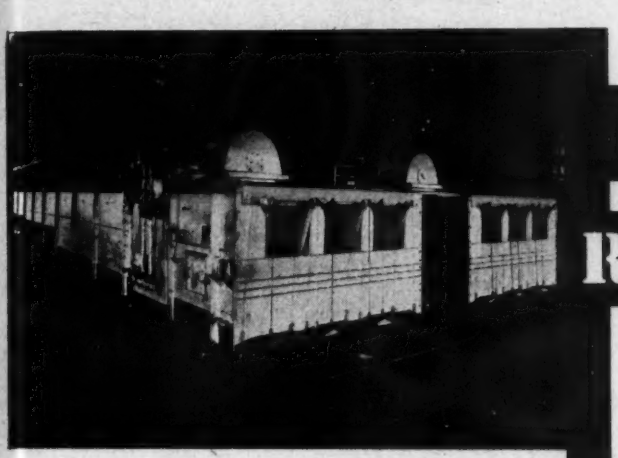

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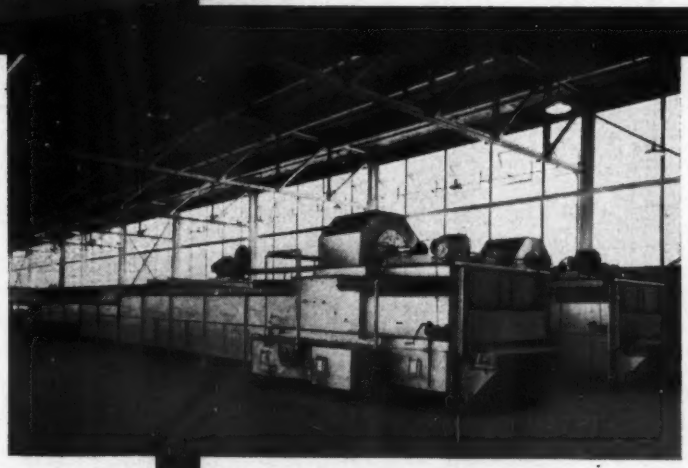
There are certain definite advantages in recirculating the heated gases under complete control to the critical annealing zones of a continuous lehr. This plan assures maximum uniformity in the finished product. Width of belt and tunnel height are not controlling factors. It requires less fuel and lowers annealing costs. It provides greater flexibility than other methods of heating and far more accurate control of temperatures in both heating and cooling zones.

2596



Controlled Recirculation is an exclusive feature of Surface Combustion Continuous Lehrs.

Write to Surface Combustion engineers for specific information.

SURFACE COMBUSTION CORPORATION

TOLEDO 1, OHIO

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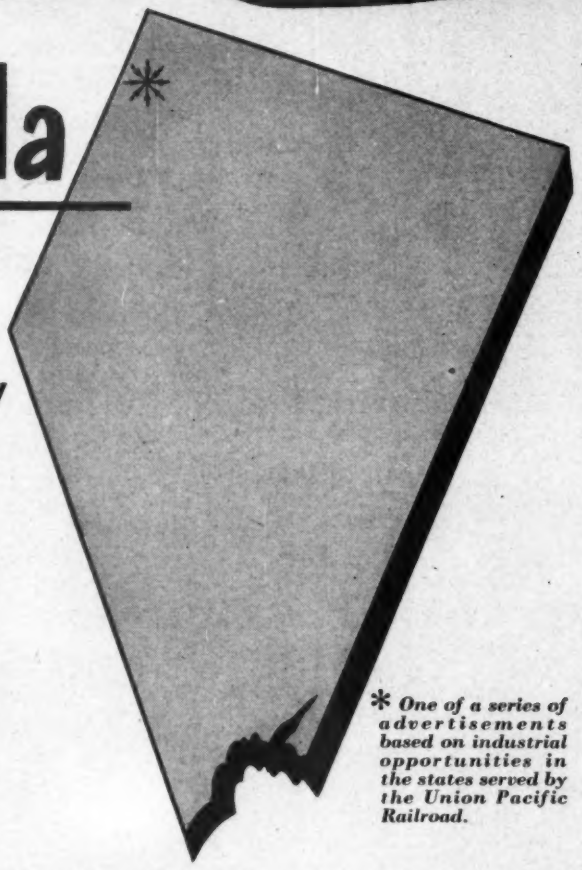
TREASURE MAP OF INDUSTRY

Nevada*



- **Variety of metals, minerals and ores of value to industry**
- **Power and irrigation projects**
- **Good living conditions**
- **Colorful scenic attractions**
- **Excellent rail transportation**

* *One of a series of advertisements based on industrial opportunities in the states served by the Union Pacific Railroad.*

Manufacturers, packers and processors will find Nevada a storehouse of raw materials. There are deposits of copper, silver, gold, zinc, lead and uranium. Mineral ores and minerals include tungsten, manganese and antimony ore, magnesite, gypsum, sulphur, borax and vanadium. Building stone and marble also are available.

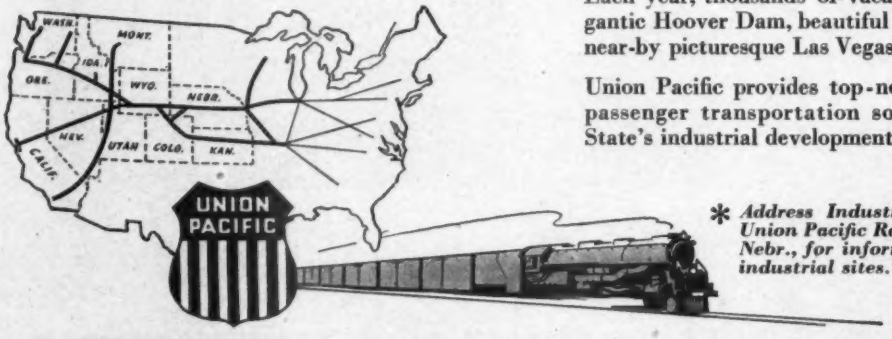
Cattle, sheep and poultry raising are expanding agricultural pursuits and there also is some production of a variety of grains, vegetables and fruits.

Irrigation and power are supplied by several Federal projects including famous Hoover Dam.

Nevada's healthful climate, excellent educational system, and a variety of scenic attractions contribute to the advantages of living in this western area.

Each year, thousands of vacationists visit gigantic Hoover Dam, beautiful Lake Mead and near-by picturesque Las Vegas.

Union Pacific provides top-notch freight and passenger transportation so essential to a State's industrial development.



* *Address Industrial Department, Union Pacific Railroad, Omaha 2, Nebr., for information regarding industrial sites.*

UNION PACIFIC RAILROAD

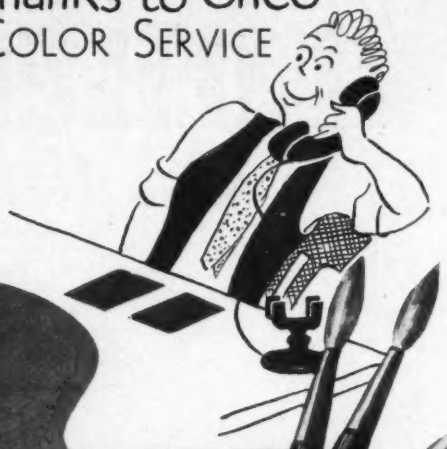
THE STRATEGIC MIDDLE ROUTE

BEFORE Trying OHCO Color Service

BUT!-BUT!-BUT! Boss we have been two weeks trying to match the color.

AFTER Using OHCO Color Service

We're on schedule with the job and the color match is perfect thanks to OHCO COLOR SERVICE



Keep yourself out of "hot spots" caused by headaches arising from mixing colors to a specified shade in your decorating department. Color matching is a specialized field wrought with production dangers at every turn for the occasional color mixing enamelist. Matching and mixing colors can be best done by specialists with equipment and "know-how" to guarantee a perfect match and consistent uniform results. It costs no more.

Your color requirements can best be met by having OHCO Color Service supply you with uniform acid, alkali, or weather resistant colors free from production troubles for spraying, squegee or brush application. . . . Ices—Gold (Liquid, brown, powder, burnish) squeegee oil.

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MANUFACTURING PLANTS
FOR ALL TYPES OF GLASS

UNDIVIDED RESPONSIBILITY
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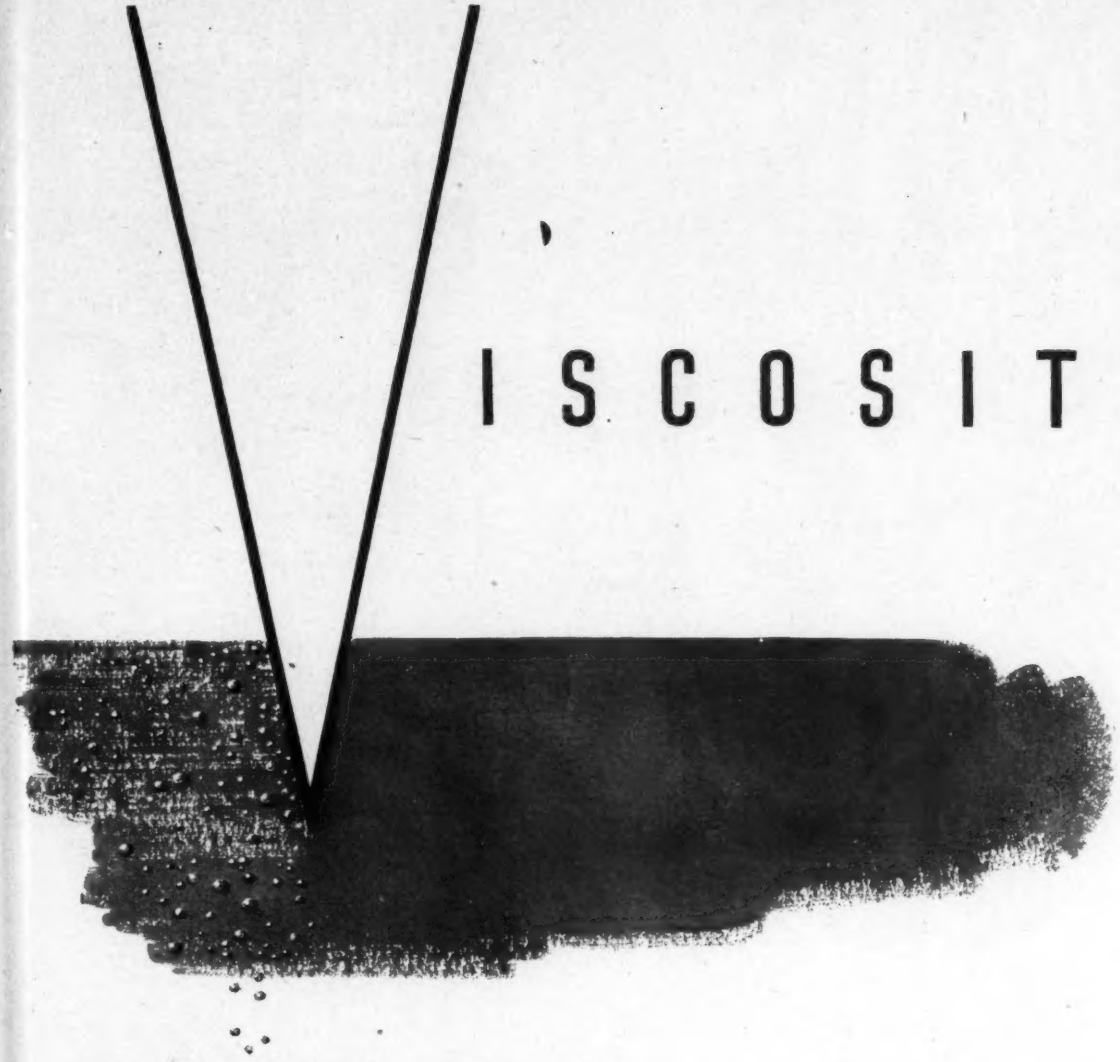


● *The proper viscosity of the glass melt is most essential in producing a homogeneous glass and one which can be more easily fined* B_2O_3 *as a minor batch constituent will help to produce the desired viscosity.*

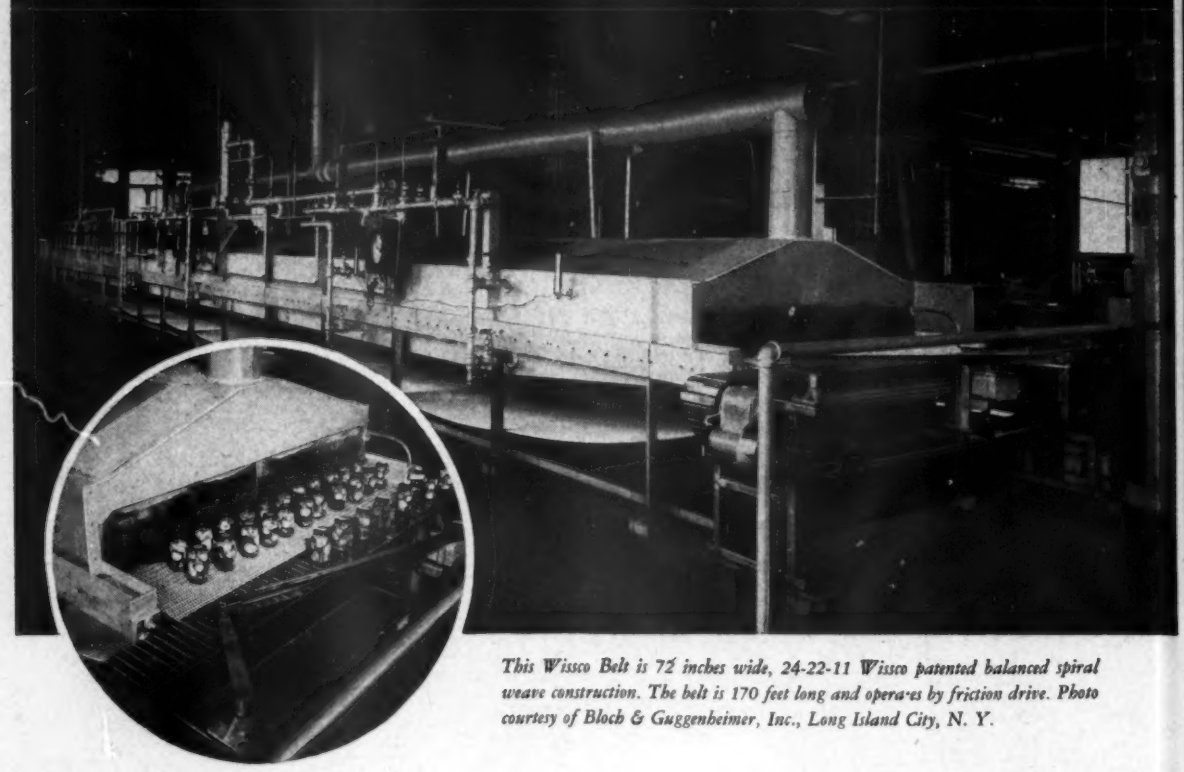
Another good reason why Borax should be used as an essential ingredient in the batch formula.

Our representatives are prepared to discuss the special advantages of B_2O_3 in glass.

PACIFIC COAST BORAX COMPANY • *51 Madison Avenue, New York 10, N. Y.*

In Pickle Pasteurizing

WISSCO BELTS PROVIDE TRIPLE BENEFITS



This Wissco Belt is 72 inches wide, 24-22-11 Wissco patented balanced spiral weave construction. The belt is 170 feet long and operates by friction drive. Photo courtesy of Bloch & Guggenheimer, Inc., Long Island City, N. Y.

After being packed, brined and capped, whole and sliced pickles are pasteurized and cooled during an 80 foot trip through the machine illustrated above. The Wissco Belt used in the pasteurizer carries a load of over six tons of pickles and the processing operation is far quicker, safer and more economical than the formerly used retort system.

The balanced spiral weave construction of this woven wire belt assures flatness, strength and freedom from side travel, while its open mesh construction provides free circulation of heat, free drainage and easy cleaning.

Wickwire Spencer's 50 years of specialization in custom-engineered belts have made Wissco Belts the accepted standard for the heat treatment of metals, glass and ceramic ware, and for food and chemical processing. Wissco Belts are built to operate efficiently at temperatures up to 2100°F. or to give long service under corrosion, abrasion and other destructive forces.

If you have a conveyor belt problem, we will be happy to cooperate in its solution. Send for our illustrated catalog showing types and advantages of numerous conveyor belt constructions.

WISSCO METAL CONVEYOR BELTS

A PRODUCT OF WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

CF&I

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THE GLASS INDUSTRY

VOLUME 28, NUMBER 12, DECEMBER, 1947

GLASS FIBERS, INC., SWINGS INTO FULL OPERATION

Vitron, A New Fibrous Glass Material; A Product of Specialized Glass, Electronic, Extrusion and Pressure Research

By FRANK E. BUTLER

The Age of Glass is at hand. Today no other material — natural or fabricated—possesses so many useful forms or purposes as does *glass* . . . estimated over 1,000, or more than all other metals and alloys combined. Credit for speeding up the progress of this modern commodity to wider and wider applications must be partially given to groups of technical experts in divergent professions such as electronics, chemistry, kinetics, etc., who have contributed their share of scientific knowledge and experience to the glass engineer toward achieving this end.

R. H. BARNARD

Of specific reference to this technological advance in glass development is that of the improved methods of manufacture introduced by Glass Fibers, Inc., of Waterville, Ohio, with their numerous patented inventions pertaining to processes of fabricating their new glass fiber product, known by the trade name of "VITRON".

R. H. Barnard, formerly executive vice president of Owens-Illinois Glass Company, began work on Vitron back in 1936. He obtained his first basic patents on the new process shortly thereafter. Finally, Mr. Barnard formed Glass Fibers, Inc., in 1945. Already nine years of research and experimenting had been carried on with some of the work being done by the laboratories at Toledo University and Cooks Research Laboratories in Toledo. All of this time additional basic patents on electronic heating were being applied for. This was necessary because Mr. Barnard was evolving a process entirely different from any other in existence.

The manufacture of glass fibers—wispy, man-made spider webs of glass, a few ten-thousandths of an inch in diameter and so light and fine that a breath will blow them away—is one of the most fascinating chapters in the annals of glass making. The rapidity and skill by which progress has been made by the organizers and technical experts of Glass Fibers, Inc., and their confidence in the future of glass fibers for industrial purposes is evidenced by the incorporation of a million dollar company and the building of an ultra-modern plant, equipped with laboratories, specially designed machinery and electronic equipment on a large tract of land which covers 65 acres and is located near the picturesque and historic Maumee River, a few miles south of Toledo. Not until the new Vitron process had definitely been proved was construction started on the new plant. One year and a half after ground was broken, the first shipment of Vitron yarn was made. Such widespread interest has been displayed by numerous manufacturers of diversified products in a number of industries that ground has been broken for erection of additional factory buildings to supplant the rapidly increasing demand for Vitron products.

Although readers of THE GLASS INDUSTRY are familiar with the product fibrous glass, it may stand re-stating, that it is, as its name implies, glass in fiber form, approximately fifteen times smaller than a human hair —mathematically classified in the order of about 0.00023 inches in diameter, having the appearance and

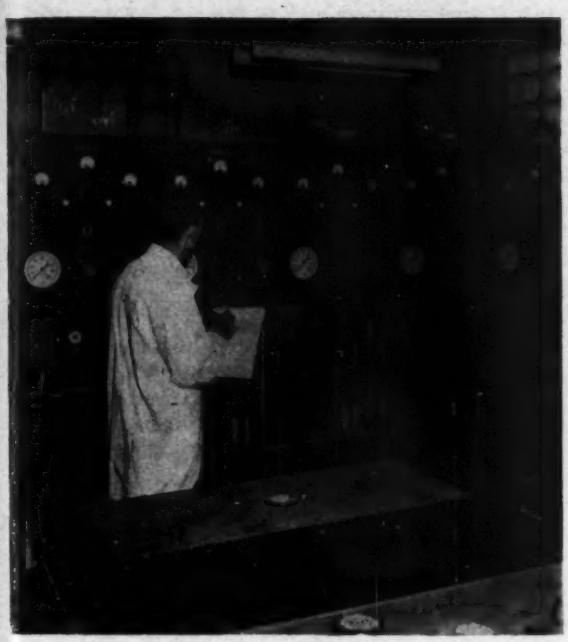
The forming operation. The glass fibers are brought down from the mezzanine, gathered together into a single strand and wound at 10,000 feet per minute on the reel below.

feel of silk. Strands of this infinite, almost invisible fiber are twisted into yarns of various, desired sizes. Thus is produced an inorganic, flexible, soft material that retains all the characteristics of common glass yet versatile as a stable fiber adaptable for weaving purposes or other uses common to cotton, wool, silk, rayon, nylon and all textile yarns. The basic properties of Vitron are manifold and possess distinctive advantages over organic yarns, namely: High tensile strength, moisture, acid and high temperature resistant, non-combustibility, thermal conductivity, high stability and durability, space eliminator, dimensional stability, electrical insulation and dielectric properties, abrasion resistance, lack of stretch, etc.

To achieve this wide variety of technical and mechanical superiority, the management of Glass Fibers, Inc., is equipped for continuous scientific research and provided with factory facilities to accomplish a complete step-by-step manufacture from the sand pile to the downy, finished product under one roof and modern production conditions. A systematic trip through this well organized establishment would start in the warehouse, where are stored in protective bins ample supplies of the basic raw materials. These are transported in measured quantities to the nearby mixing center where the raw materials are carefully weighed in a hopper connected to an automatic recording scale, after which they are placed in a power driven rotary batch mixture to which is added the required amount of alumnia and boric oxide. When this mass is thoroughly mixed the mixture is loaded into batch buckets which are hoisted overhead and travel on a Cleveland Tramrail system to a specially designed conversion or "batch-furnace," the only one of its kind. The furnaces operate 24 hours a day, every day of the year at a uniform temperature of 2750 degrees F. This carefully blended mixture delivered to the furnace contains no soda, potash or other substance of alkali content. It produces a product of glass equal in all forming and operating properties to high grade optical glass. A battery of several dozen gas jets located on three sides of elongated furnaces supplies the required heat from a low pressure supply line which has been reduced from 45 pounds to as low a pressure as ½ pound. However, gas is not the only heat applied to melt and refine the glass making mixture. Augmenting the gas jets are parallel electrical heating units which heat the furnace in conjunction with the gas jets producing more heat. However, the electric supplement provides a method of easier heat control which is a necessary adjunct. The capacity of a single furnace is about 40 tons of glass. The molten glass emerges from the furnace in a stream nearly one inch in diameter. On being exposed to the air in a four inch drop, it is automatically sheared, depositing a small piece of glass between two revolving cylinders grooved spirally. This permits the hot glass to travel, revolve and shape itself into a round, glass marble about ¾ inch in diameter; the perfectly formed ones finding their way into a metal receptacle and the rejects or defective ones dropping into a salvage bin, later to be broken up and ground into small particles of glass to again pass through the furnace.

The next operation is the sorting and inspection of the cooled and finished marbles. Each specimen is scrutinized for defect or impurities; those containing only a few small air pockets ("seeds") are acceptable, but those having larger bubbles or misshapen are rejected. The acceptable batch is then placed in paper lined cloth

The marble forming operation. The glass comes out of the forehearth in a molten stream, is sheared off into small pellets, the pellets then being formed into marbles as they travel between the revolving tubes.

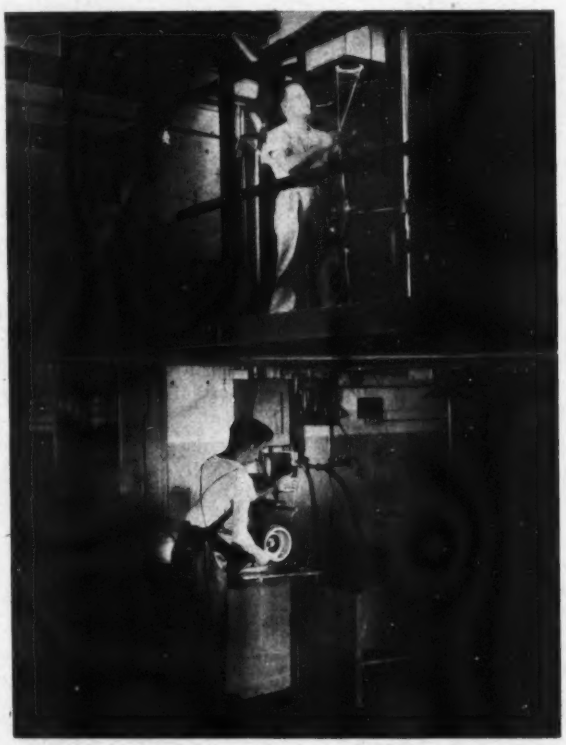


This furnace employs the use of both gas and electricity to produce an extremely even melting heat.

sacks, 100 pounds to a bag, tagged and stored in the stock room ready to be spun into glass fibers. At intervals of several times each hour, samples of marbles are taken from the sorting table to a control laboratory for the purpose of testing the current run where they are checked for softening point, purity of composition, freedom of foreign matter, size, etc. A visual inspection is made with a petrographic microscope and a "Seed-scope," an optical instrument developed by Preston Laboratories, then it is further subjected to a physical properties test which quickly and more accurately evaluates quality than would long, drawn out chemical analysis. Such a test of softening point measures temperature at which the viscosity of the glass is such that its logarithm is 7.65. Density is also determined by a sink-float method, whereby a marble sample is placed in a heavy liquid; the tube and liquid being immersed in a water bath. The liquid possesses a high temperature coefficient. By altering the temperature of the water bath it is possible to also alter the density of the liquid and by varying the density of the liquid, the density can be found at which the glass marble either floats or sinks, thereby disclosing valuable information as to uniformity or quality of the subjected specimen. If deficiencies appear, the cause can be quickly located either in the batch, mixing, melting, heat, speed of operation or one of several stages of production. This careful and systematic test indicates the great care and accuracy required to turn out a perfect product and is one of the reasons responsible for the high quality of Vitron glass fibers—determining softening point and density of marbles being the two most important points demanded.

The marbles are now ready to be supplied to any or all of the twenty hoppers in the fiber forming room. Here they are fed one by one with uniform speed and timing through a tube by both gravity and air pressure into a specially designed oven, heated electronically by high frequency currents. This modern method of controlled, even heat produces results that cannot be duplicated in any other way; it converts ordinary 60 cycle power, first into a form of direct current before it is finally converted into high frequency alternating current of waves to the order of half a million or more cycles per second. It is capable of heating or melting objects not possible with lower frequencies or any other known method of generating and applying heat to a concentrated point. The high frequency power output is fed by a pair of external leads to a "load coil" of a certain number of turns, fitted closely around a specially designed circular crucible made of pure platinum, having holes or orifices through which fibers of molten glass flow. There are twenty of these high frequency furnaces operating to full capacity, day and night in costly platinum crucbiles. The turns of the above mentioned coil act as the primary of a transformer while the platinum crucible is the secondary of the transformer. Current from the electronic heater circuit flowing through the turns of the load coil causes a corresponding current to circulate within the platinum crucible, and produces heat approximating a constant, uniform temperature of 2400 degrees Fahrenheit. Because of the high frequency employed this current tends to flow mostly in the outside portions of the platinum crucible with concentration in the area of the 204 orifices or openings.

Due to the method by which glass fibers are formed, grouped and treated preliminary to winding on a primary cylinder, the forming room requires a mezzanine floor, or landing, built between two higher ones. The floor above contains the long rows of twenty electronic amplifiers, oscillators, transformers, etc., for generating the necessary different types of electrical circuits. These are fed to the mezzanine below where, located near its roof, are the twenty high frequency coils enclosing the plati-



Vitron yarn being tested for tensile strength on a Scott tester.

Atwood Twisting and Plying Frames. The latest in textile equipment. The yarn is being brought down from three of the bobbins on top and twisted into one strand on a single bobbin below. This operation is being duplicated on hundreds of other bobbins.

num crucibles. A small opening in the mezzanine floor permits the ejected 204 strands of molten fibers from the crucible, after being carefully grouped by the hands of a skillful operator, to be dropped or guided to the floor below, there to be caught by another experienced operator who guides and winds the strands on a ten inch plastic cylinder, ready for inspection on its way to the twisting machines.

Perhaps the most critical and important point in the fabrication of glass fibers is the operation on the mezzanine floor where the crucible transforms a glass marble into a strand of glass fiber so infinite in size as to be almost invisible. It is possible to extract approximately ninety-seven miles of filament glass from a single sphere. The strand at this point travels from the crucible orifice at the speed of about 2 miles per minute in company with 203 similar fibers emanating from a single forming unit. In close rating with the importance of high frequency current in producing the high degree and type of heat required is the method of employing the proper amount of pressure exerted on the flow of molten glass through the crucible orifices and the ingenious process of continuous extrusion employed in forcing the flow to produce the desired shape and cross section of each individual fiber.

The multiple strands are carried to the floor below where high speed winding mechanism draws the rapidly moving fibers with a precision tension which attenuates the glass while it is still in a molten shape, thereby drawing the fibers down to a size considerably smaller than at the orifice. Diameter and length of the individual fiber are subject to control by regulating the temperature and viscosity of the glass, the orifice size and the pressure, while the depth of the mass is controlled by the speed of the fibers.

On the downward journey from the forming crucible to the rapid winding machine the 204 fibers are subjected to a spraying lubrication process that implants an extremely thin film of oil between all of the fibres, without which the slightest scratch or pull would sever the strand. Following this there is another spray operation of water vapor which, with the rapidity of the fast moving fibers, cool them sufficiently to be immediately wound on a receiving cylinder. These cylinders, carrying about 20 miles of continuous glass strands, are now transferred to the twisting room which is subjected to electro-static air conditioning and cleaning, having a relative humidity of 80 degrees. This is necessary so that in the winding on spools of the raw fibers they will not be subjected to any air impurities such as dust particles nor twisted under conditions of improper humidity. The first operation in this room, however, is to inspect each cylinder of fiber and weigh a portion of it to determine its accuracy. The cylinder is now taken to the twisting machine which combines several strands to form a fine yarn. Thereafter the yarn may be plied by twisting two or more together to provide any desired yarn, thread or cord construction. Standard textile machines such as Atwood twisters and Universal winding machines are used with suitable modifications for all these operations, all of which are wound on standard textile bobbins which, in turn, are rewound on standard textile cones suitable for the customer's weaving operations. Previous to this, however, the standard bobbins of yarns are subjected to a final test on a Scott tester for tensile strength after which they are placed into individual shipping cartons, slotted so as to insure that each of the 16 contained cones will not shift in location and thereby damage the fibers.

Because it is the first time in the art of glassmaking that high frequency heat, combined with pressure, has been employed on a commercial basis, it is felt the electronic equipment located above the mezzanine of the forming room deserves elaboration. Here is housed a battery of twenty, ceiling high electronic panels and huge cabinets of oscillators capable of handling large capacities, all designed and constructed by Vitron engineers. Rows of heavy duty transformers of 17,000 volt capacity furnish the necessary current supply for all the electrical work involved in the high-frequency apparatus. Elec-

(*Continued on page* 658)

The glass which goes into Vitron yarn is constantly subjected to laboratory tests for density, softening point and composition.

G.C.M.I. HOLDS SEMI-ANNUAL MEETING IN MIAMI

Mr. Robert L. Warren, the newly elected President of the Glass Container Manufacturers Institute, called to order at 10 A.M. November 3 the semi-annual meeting under the auspices of the Board of Trustees of the Institute to receive Committee reports. The meeting was held at the Sea Isle Hotel in Miami Beach, Florida, and lasted three days with each session occupying a half day.

Testing Procedures

After Mr. Warren's opening remarks, the first report of the Nine Standing Committees to be given was that of the Committee on Testing Procedures whose Chairman is Mr. Ronald W. Lester of the Maryland Glass Corporation. Preceding this report, Dr. Frank W. Preston commented on the importance of the work of the Committee.

In his report on the organization of the Committee, Mr. Lester pointed out that there was only one change in the membership of his Committee and this was the resignation of Mr. C. E. Stevenson of the Diamond Glass Company. His place has been filled by R. V. Yount of Knox Glass Associates, Inc.

It was brought out by Mr. Lester that the present status of the Committee's program is composed of two phases of activity; one the legal phase and the other the research phase, both of which are integrated at certain points.

In this connection, the Committee's report states, "The nature of this program is such that the Committee members cannot carry out these various activities either individually or collectively. Accordingly, the prime purpose of your Committee on Testing Procedures is to meet and receive progress reports from the Consultants and Fellows that have been retained to carry out the above mentioned program on activities and, in addition, advise them on present day problems and on all data pertaining to these problems that have been obtained by various individuals either in or out of the Committee's personnel. Much of this report will, therefore, be a brief summary of the activities and progress of our Consultants and Fellows."

Two bulletins and one report have been sent to the industry during the last six months. A bulletin on water hammer breakage was timed to reach glass manufacturers prior to the catsup packing season since such packs are susceptible to this type of injury. The bulletin briefly summarized the phenomena of water hammer breakage, its cause and prevention. Another bulletin on the Effect of Temperature on the Strength of Glass and a report on the Service Life of Glassware dealt with fundamental work being carried on by Dr. Preston and his staff. It was stated that highly technical studies such as these are presented in a forum that the layman can readily understand and it is the intention of the Committee on Testing Procedures to continue their distribution. With regard to the Cord Research Program, Mr. Lester's report enumerated the various phases of this work which have been completed.

The Committee's work on impact research was briefly outlined by Mr. Lester mentioning, among other things, the coordinated efforts of Dr. Preston and independent investigators with those of the Institute's Committee on Testing Procedures.

Glass Packed Products

Dr. J. M. Sharf of Armstrong Cork Company and Chairman of the Technical Committee on Glass Packed Products was next to present his report.

Dr. Sharf related that two meetings of his Committee had been held since he made his last report to the membership of the Institute. The first of these meetings was held in Chicago last May in cooperation with representatives of the National Canners Association and covered the review and interpretation of the experimental work carried out in the NCA's West Coast laboratories. The second meeting took place in New York in June and was for the purpose of reviewing with manufacturers of retorts and control instruments the proposed tentative recommendations for vertical retort hook-ups for use with glass packed products and to review the work sponsored at the University of Massachusetts. Dr. Sharf further stated that another meeting was contemplated for some time during the month of November with the Massachusetts University group and that subsequent meetings would be held with the retort and instrument manufacturers.

Further in his report, Dr. Sharf outlined in some detail the cooperative retort processing studies with the National Canners Association and also described the research program which has been carried on for some time at the University of Massachusetts. In connection with the work at the University, several definite lines of study have been laid down.

Package Design and Specifications

In the absence of Mr. P. A. Parker, Anchor Hocking Glass Corporation and Chairman of the Committee on Package Design and Specifications, Mr. B. H. Taylor, Traffic Director of the G.C.M.I., presented Mr. Parker's report.

The report briefly touched upon Classification Rule #41 and its provisions for the packaging of empty glass containers and products in glass. In his report, Mr. Parker stated, "The packaging specifications for empty glass containers and products in glass, now a part of Classification Rule #41, do not represent the final judgment of the Committee as to what they should be. The Committee believes it has sufficient data from which sound conclusions can be drawn to indicate that a large part of transit damage to glass packed products is not attributable to any inherent vice in the several types of corrugated fibre cartons and interior packing now in use. It is its unanimous opinion, however, that the Industry should continue to carry on further studies to develop more adequate facts as to causes for transit damage. Such further investigations are now planned and some of the preliminary work done."

It was further stated that in negotiating the emergency specifications currently in effect in Classification Rule #41 with the railroads, the Committee on Package Design and Specifications committed itself to explore the possibilities of ultimately developing a performance standard to be made a classification rule in lieu of the detailed specifications now in that rule. This exploratory work

is now a definite part of the Committee's activities and is being advanced as rapidly as circumstances permit. In presenting a resume of the Carton Research and Development Program, Mr. Taylor briefly outlined six basic objectives to which the Committee is directing its energies in this phase of its work.

Mr. Parker's report further pointed out that in order to achieve these objectives, laboratory research under the direction of a man qualified in every respect to carry on such a program was necessary. In this connection, it is felt that the Institute was fortunate in obtaining the services of Mr. John G. Turk, a graduate of the University of Texas and the Institute of Paper Chemistry and with four years of practical fibre carton research experience, the last two years spent as a staff member of the latter institution. Mr. Turk, now a staff member of the G.C.M.I., makes his headquarters at the Preston Laboratories in Butler, Pa. A modern and complete laboratory will soon be in full operation under Mr. Turk's direction and Mr. Parker stated that it is hoped in his next report to the Board, some actual results of the industry's carton research and development program can be given.

Government and Industry Relations

The next report to be heard was that of the Committee on Government-Industry Relations, whose Chairman is Mr. Lewis F. Gayner of the Gayner Glass Works.

In presenting a resume of his Committee's activities, Mr. Gayner pointed out that during the period covered by his report, the last remaining agency of what was originally the War Production Board was liquidated by the Government; namely, the Office of Temporary Controls which closed its doors on May 4, 1947. He further pointed out, however, that control over some materials remained after that date and of the several materials not decontrolled, those of considerable importance to the glass container and closure industry were tinplate and tinfoil.

In connection with these restrictions, Mr. Gayner stated, "Order M-43, which specifies the weight of tinplate that may be used in closure manufacture and what products may use tinfoil as a closure liner, is in the same form as when it was amended on February 6, 1947. Order M-81, controlling the weight of tinplate for can manufacture, also continues in effect as amended December 27, 1946. These two regulations and a few others deemed necessary because of the critical nature or supply outlook of the products involved are administered by the Office of Materials Distribution, a specially created office of the Bureau of Foreign and Domestic Commerce."

Further in his brief report, Mr. Gayner stated that an early revocation of restrictions on tin mill products is considered unlikely. Some gradual improvement has been evident in domestic receipts of pig tin and the overall world supply. However, demand has been out-racing the rate of gain. No alleviation in the tight supply of steel for at least another year is expected which, of course, will govern the quantity of plate available for tinning. The Government's program of aid to Europe is further expected to intensify shortages in steel and allied products.

Market Research and Promotion

The session of the second day of the meeting was devoted exclusively to the report of the Committee on Market Research and Promotion, headed by Mr. I. J. Collins, Chairman of the Board of Anchor Hocking Glass Corporation.

In his report, Mr. Collins briefly reviewed the current history of the idea of an industry promotional campaign to safeguard present markets and expand the use of glass as a packaging medium. He outlined the discussions and actions taken at the Asheville Semi-Annual Meeting last May and stated that several points established at this meeting had been carried out, while other factors were still in a stage of development.

Mr. Collins' report outlined the 1-Way beer bottle campaigns undertaken on the West Coast and in New England pointing out the then existent reasons for instituting these campaigns at the time they were started. It was stated that although some values have been derived from these specific promotions, namely, the establishment of consumer demand and acceptance for the 1-Way beer package, results indicate that not sufficient time was allowed for planning and follow-through to make the effort as resultful as it could have been.

This led Mr. Collins to stress emphatically the importance of allowing enough time for planning and research between the time that a promotional campaign is approved and prepared and the opening shots are fired. Mr. Collins stated much valuable experience had been gained in the two sectional beer programs which should be useful in future promotional activities.

To assist in the task of formulating a plan of industry-wide promotion, Mr. Collins stated that the services of the market research organization of Stewart, Dougall & Associates had been obtained. Mr. Charles S. Roberts of this concern was introduced and gave a detailed report of his investigations.

Standards and Finishes

Opening the session on the third day of the meeting, the report of the Committee on Standards for Finishes was presented to the assembled members. Mr. C. C. Green of Armstrong Cork Company is Chairman of this Committee.

After briefly outlining the membership of his Committee including those of contributing companies who work with the Committee, Mr. Green told of meetings which have been held in connection with the work on standards for finishes. He stated that his Committee has been diligently reviewing and simplifying drawings of glass finishes issued by the dissolved Glass Container Association. This work and all efforts along this line are extremely involved, it was pointed out, since there are so many factors to be considered in the development of a glass container finish. Among these various factors, Mr. Green listed the need for considering the mold makers, bottle forming machines, closure manufacturers, packers and the ultimate consumer of glass packed products.

Traffic

The report of the Traffic Committee, whose Chairman is Mr. I. L. Dunnington of Anchor Hocking Glass Corporation, was presented to the membership by Mr. B. H. Taylor.

The much discussed Classification Rule #41 was briefly touched upon by Mr. Taylor. He said, "This complicated railroad tariff rule is supposed to fix the specific manner

in which all freight, other than that in bulk, must be packaged for transportation purposes. Because one section or another in it is revised so frequently, it is a subject that is necessarily continued on the Committee's docket. Since its last semi-annual report, there has been published in section 5 of this rule detailed interior packing specifications governing the packaging of products in glass containers. These specifications became effective June 15, 1947. As previously reported, the Committee on Package Design and Specifications is now engaged in directing an industry carton research and development program from which it believes there can be developed more realistic spelled out requirements for packaging empty glass containers and products in glass. When that program has progressed sufficiently to warrant renegotiating the specifications that have been published, both Committees will collaborate in seeking the desired modifications."

Another matter Mr. Taylor succinctly described was that of the efforts of the railroads in the Eastern Territory for the past four years to increase the ratings and carload minimum weights on corrugated pulpboards and corrugated fibre boxes. He stated that while rates themselves have been increased several times, the underlying basis for present rates and carload minima has been in effect since 1912. The Committee, he stated, believes there is no justification for changing that basis and, therefore, has protested the proposed adjustment.

Despite these protests, Mr. Taylor stated, an adjustment was published to become effective April 15, 1947. Mr. Taylor presented the details of these adjustments in his report.

Following the publication of these tariff changes, the Interstate Commerce Commission suspended them on the strength of several shipper petitions, among them one filed by the Glass Container Manufacturers Institute.

Mr. Taylor stated that briefs in the proceeding are not due until February 1, 1948. Therefore, it will take several months before the Commission reaches a decision.

Further in his report, Mr. Taylor related the status of Interstate Commerce Commission Dockets #28300 and #28310. These two proceedings were initiated by the Commission on its own motion in 1939 and resulted in an order in 1945 requiring the establishment of a uniform freight rating classification for application throughout and the publication of a single scale of class rates also for nation-wide application. Mr. Taylor stated that the lawfulness of these orders had been contested by a number of state governments and the Western Railroads in a Federal District Court. However, after reaching the United States Supreme Court, that Court held that the Commission had properly entered the orders.

Referring to the effect of these orders, Mr. Taylor stated, "The railroads are now engaged in the preparation of a uniform classification and have publicly docketed the first of a series of proposals for uniformity. The Committee believes that when and if a uniform classification is made effective, it will replace most classification exceptions ratings which now apply on glass containers and practically all raw materials entering into the manufacture of glass. These exceptions ratings are lower than straight classification ratings."

In connection with the single scale of distance class rates prescribed by the Commission and which were ordered to be made effective concurrently with the establishment of a uniform classification, Mr. Taylor stated that the several general increases in freight rates that have subsequently been authorized makes that scale meaningless now. When all of the implications involved in these two proceedings are assessed, the Committee believes it will be the most controversial traffic subject ever before the American shipping public.

In closing his report, Mr. Taylor stated that in viewing the overall transportation pictures from a standpoint of costs, he felt that the circumstances were such that his report had to be a pessimistic one.

He gave detailed facts concerning various charges that have been imposed and are contemplated and outlined the position of the glass container industry with regard to certain of the increased freight rates.

Container Design and Specifications

Next on the program was the report of the Committee on Container Design and Specifications. Mr. J. M. Foster, President of Foster-Forbes Glass Company, presides as Chairman. This Committee has three sub-committees; one on beer bottles headed by Mr. G. A. Mengle of Brockway Glass Company, another on milk bottles headed by Mr. R. M. Lamb, Jr., of Lamb Glass Company, and the Technical Sub-Committee whose Chairman is Mr. G. M. Stuntz. Mr. C. E. Wagner of the staff of the Glass Container Manufacturers Institute serves as Secretary to the Technical Sub-Committee.

In his opening remarks, Mr. Foster pointed out that while numerous meetings have been held by his Committee, the actual effort put forth cannot be measured by the number of meetings held since much of the activity of the parent Committee and its sub-divisions is conducted by correspondence clearing through Mr. Wagner, the Secretary.

Mr. Foster outlined the work of the Committee during the past six months in completing specifications and adopting drawings for a number of new container lines which were required by packers. Mr. Foster also described the development of specifications for new container lines of particular interest to the West Coast container manufacturers since it involves wine bottle shops.

Another matter which has received attention from the parent Committee is the conversion of drawings of old container lines. In this connection, the Technical Sub-Committee is reviewing specifications for container lines that were temporarily out of use during the war but for which the parent Committee anticipates renewed demand.

A statement of particular interest made by Mr. Foster pertained to the apparent disinclination of packers to demand private design containers even though the industry has not been running to capacity during the past few months. It is felt that the principle reason for this may be due to greater economy in filling operations, distribution channels and warehouse inventories which are affected by the use of these items.

In closing his report, Mr. Foster stated, "In continuing its effort to provide specifications for containers for which a definite demand is found, the Committee hopes to fulfill its obligation to the glass container industry, the packers, equipment manufacturers and the ultimate

(*Continued on page* 661)

EFFECT OF COLORING OXIDE ADDITIONS ON THE SPECTRAL TRANSMISSION OF A SODA-LIME-SILICA GLASS

By GEORGE S. BACHMAN

Pittsburgh Plate Glass Company, Creighton, Pa.

I. Introduction

Up to the present time, there has been no systematic investigation published concerning the effect on spectral transmission—ultraviolet, visible, and infrared—of the addition of coloring oxides to a base glass with a composition similar to that of the great majority of commercial glasses. It was thought that such an investigation should prove to be of value, from a practical as well as a theoretical standpoint.

The fact that glasses have the ability to transmit invisible as well as visible radiation has been known for a long time. At the beginning of the Nineteenth Century it was observed that a thermometer placed in the spectrum of a glass prism registered an increase in temperature, and that this increase took place not only in the visible band of colors, but on the invisible side of the red region also. Ampere suggested that this formation of heat in an invisible zone was due to an invisible radiation, and this surmise was later verified by the diffraction and polarization of these rays, which have been termed "infrared" because of their position in the spectrum. This radiation is similar to visible radiation except that the wave lengths are longer. On the far side of the violet band of the visible region is found the invisible radiation known as ultraviolet radiation. The wave lengths of ultraviolet radiation are shorter than those of visible radiation. This radiation also has a heating effect when absorbed by a substance, and many other interesting properties.[1]

Quite a few substances have little or no absorption of light in the visible region; therefore, they appear uncolored to the eye. All substances, however, absorb in the infrared or ultraviolet regions of the spectrum. Nearly all glasses possess better transmitting ability for infrared than they do for ultraviolet.

Ordinarily, the amount of light transmitted by a substance is measured by visual means, photographically, or by means of a photocell, but in the infrared beyond about 1500 millimicrons wave length none of these methods is applicable. The best method is to measure the heating effect of the radiation, which is done with a thermocouple.

In measuring the transmitting ability of glasses, the intensity of the radiation after it has penetrated the glass specimen is compared to the intensity of the radiation incident upon the glass. It is evident that the total loss in radiation intensity on passing through the glass plate can be accounted for by separate processes: (1) reflection from the two surfaces of the glass, and (2) absorption by the glass itself. Since the amount of reflection is of course dependent on the condition of the glass surfaces, it was thought best to eliminate this variable and to report the data on the basis of "internal transmittance," which is the radiant energy incident on the second surface divided by that transmitted by the first surface. In order to follow this procedure, the over-all transmission and the reflection losses for each glass specimen must be known. The over-all transmission is the observed transmission, uncorrected for reflection. The reflection losses were determined by means of observations in the visible region and the use of the Fresnel reflection formula[2]: $R = \left(\frac{n-1}{n+1}\right)^2 \times 100$, where "R" is the per cent reflection for each surface, and "n" is the index of refraction of the glass for the spectral range under consideration.

II. Review of Literature

The so-called "ionic" colorants are the most important coloring agents for glasses. Their coloring action is due to the fact that certain electrons of the colorant ions can absorb energy of a definite range of frequencies from the incident radiation. When this selective absorption takes place in the visible region, the sensation of color results. Most ionic colorants belong to the first transition group of the elements.

Norton[3] has discussed the action of coloring oxides, and has also included a bibliography.

W. Weyl[4] and his associates have contributed greatly to our understanding of coloring effects in glasses. Weyl groups the coloring oxides into those in which the variation in color is due to differences in the ionic environment in the glass, which explains why ions of the same element and in the same state of oxidation produce different colors in different base glasses, and those in which it is due to differences in oxidation, e.g., the color of pentavalent vanadium as contrasted with trivalent vanadium.

Since all portions of the spectrum produce heat upon absorption, it is obviously impossible to exclude all heating effects and still transmit light. However, a great deal has been done on the development of glasses which will transmit well in the portion of the spectrum that is desired and largely exclude the unwanted portions. For example, "heat-absorbing" glasses, which have a high transmission in the visible region and a low transmission for the invisible portions of the spectrum, have been known for a long time.[5] Also, glasses which transmit well in the ultraviolet spectrum have been developed, largely for therapeutic and sanitary purposes.

Many researches on the influence of coloring oxides

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[1]C. Ellis and A. Wells, Revised by F. Heyroth, The Chemical Action of Ultraviolet Rays. Reinhold Publishing Co., New York, 1941. 961 pp.
[2]George W. Morey, Properties of Glass, p. 439. Reinhold Publishing Co., New York, 1938. 561 pp.
[3]F. H. Norton, "Color Formation in Glasses and Glazes," Glass Industry, *16*, 45 (1935).
[4]W. Weyl, "Coloured Glasses," J. Soc. Glass Tech., Trans., Part I, *27*, 133-206 (1943); Part II, *27*, 265-295 (1943); and *28*, 158-266 (1944); Part III, *28*, 267-354 (1944); Part IV, *29*, 289-389 (1945); Part V, *30*, 90-172 (1946).
[5]Sir William Crookes, "The Preparation of Eye-Preserving Glass for Spectacles," Trans. Roy. Soc. London (A) *214*, 1-25 (1914).

on the spectral transmission of glasses have been published. A few of these will be mentioned:

Schweig[6] reviews the influence of various additions to glass with regard to spectral transmission. The ferric ion is an effective ultraviolet absorber, while the ferrous ion is an effective infrared absorber—hence, the state of oxidation of the iron content is of great importance. Other effective absorbents of ultraviolet radiation are titanium, lead, antimony, cerium, vanadium, cadmium, and arsenic. Phosphate glasses are good transmitters of ultraviolet light, but are not resistant to weathering. Lithium (sodium, potassium)-beryllium-boron glasses are also good transmitters of ultraviolet light, but are expensive. Ferrous iron is the most effective addition for heat-absorbing glasses. Antimony and arsenic may also be used for this purpose.

Densem and Turner[7] prepared a series of twenty-six glasses containing from 0.002% to 12.5% of iron oxide expressed as Fe_2O_3 under precisely similar conditions. The composition of the base glass was 75% SiO_2, 10% CaO, and 15% Na_2O. The maximum dissociation of the Fe_2O_3 (to FeO) occurred at a total iron oxide content of 0.04% Fe_2O_3, and fell steadily until it reached a nearly constant value of about 9% for iron oxide concentrations between 3% and 12.5%. The corresponding colors depended both on the degree of dissociation and on the total iron concentration, blue-greens predominating up to 0.1% Fe_2O_3, greens from 0.2% to 0.9%, and olive greens from 1 to 2%.

The most comprehensive treatment of the transparency of glasses is that of Fritz-Schmidt, Gehlhoff, and Thomas.[8] Their results are expressed in fifty-nine sets of curves. Their investigations fell into three principal groups: 1. Glasses of 82% SiO_2, and 18% Na_2O, with replacement of the SiO_2 by various oxides, including coloring oxides. 2. Glasses of composition: 80% silica plus alkali oxide, and 20% boric oxide plus lead oxide, with replacement of the silica by increasing amounts of the alkali oxides—lithium oxide, sodium oxide, and potassium oxide. 3. Four-component glasses: 65% silica, 15% sodium oxide plus potassium oxide, and 20% barium oxide. Their results may be summarized as follows:

In the ultraviolet range, pure silica glass is not surpassed in transmitting ability by any silica-containing glass. Good transmission was obtained with additions of alkalis, alkaline earths, zinc oxide, boric oxide, and aluminum oxide; these compounds are without great influence on the absorption limits of the glass. Nickel oxide and cobalt oxide are useful additions where ultraviolet transparency is to be combined with visible absorption. Absence of iron is imperative. Absorption of ultraviolet light is obtained in colorless glasses with vanadium, cerium, titanium, lead, and antimony, in order of decreasing effectiveness.

In the visible range, the well-known absorption bands are present.

In the infrared, silica glass has superior transmission, being completely transparent to 3.6 microns, has absorption bands at 3.3 and 4.3 microns, and the transparency decreases to low values at 5 microns. Except for the

[6]Bruno Schweig, "Invisibly Coloured Glass," Glass, *19* (7) 174-76; (8) 199-203; (9) 230-32, 235, 237 (1942).

[7]N. E. Densem and W. E. S. Turner, "The Equilibrium Between Ferrous and Ferric Oxide in Glasses," J. Soc. Glass Tech., *22* (94) 372-89T (1938).

[8]M. Fritz-Schmidt, G. Gehlhoff, and M. Thomas, "Die physikalischen Eigenschaften der Gläser in Abhängigkeit von der Zusammensetzung," Z. tech. Physik, *11*, 289-326 (1930).

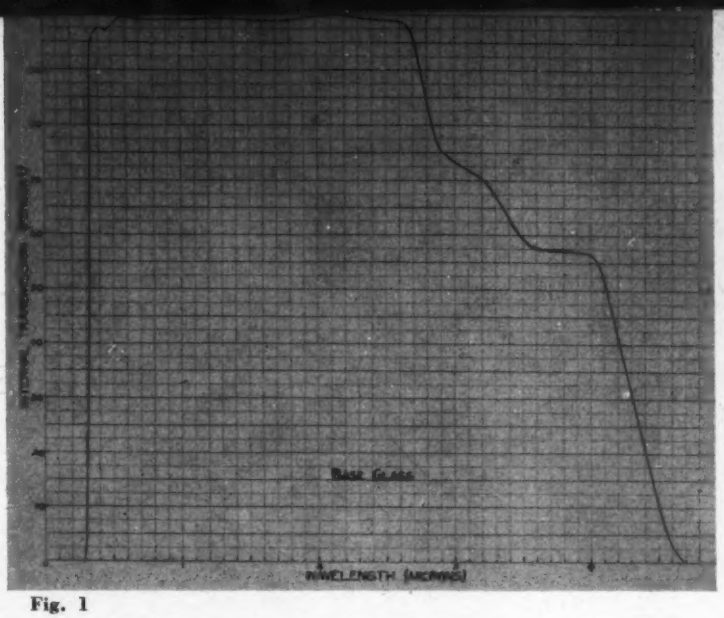


Fig. 1

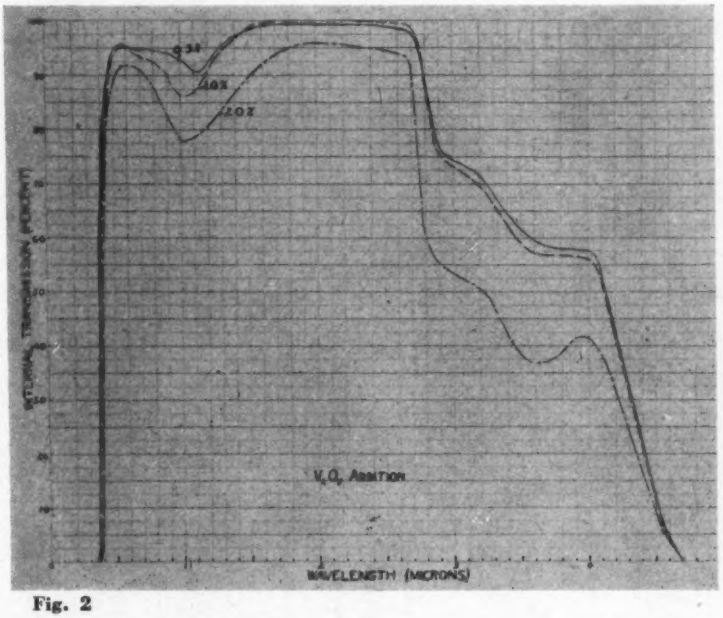
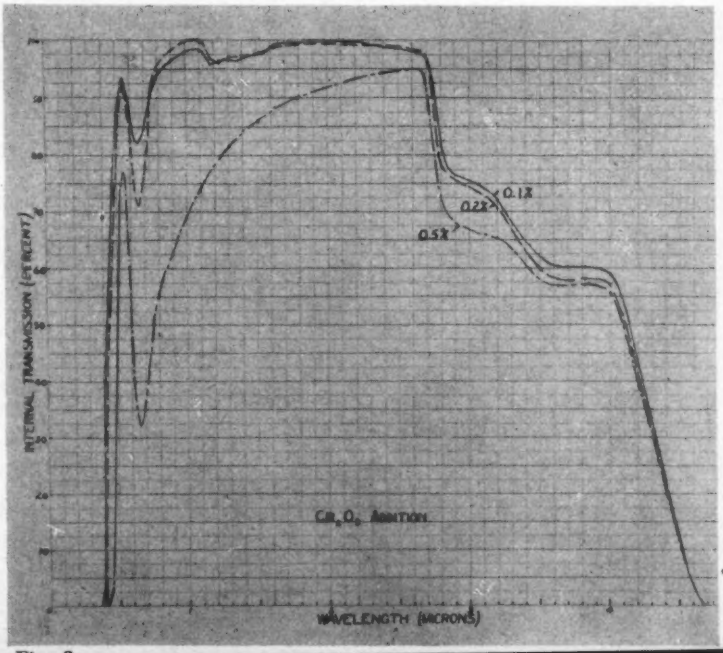


Fig. 2



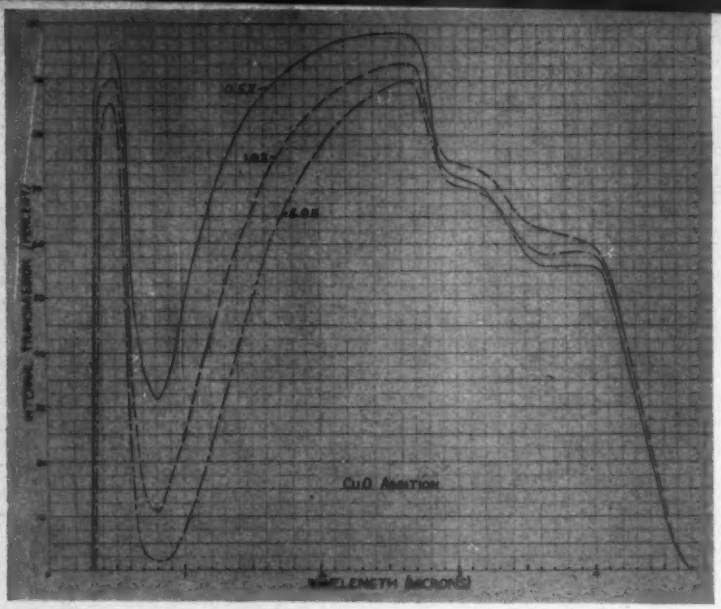


Fig. 4

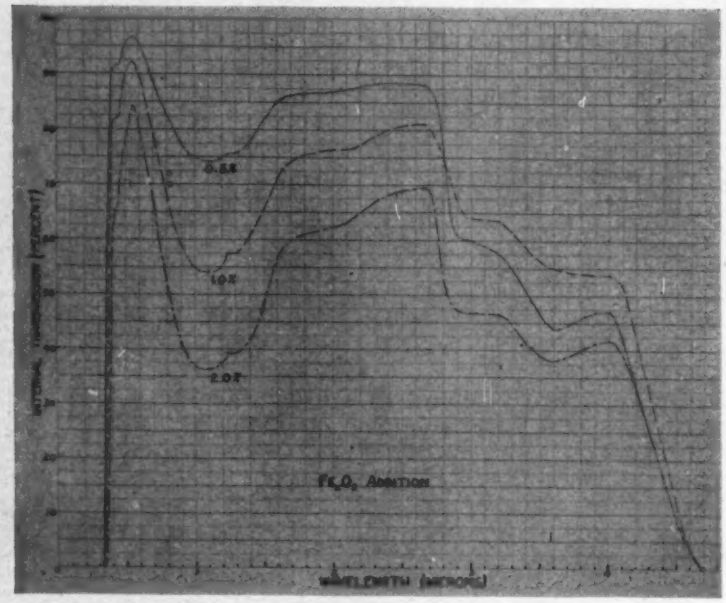
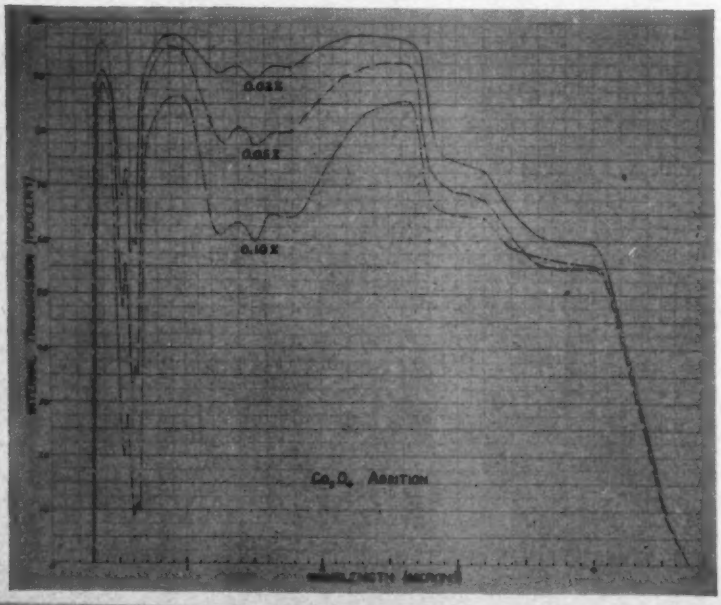


Fig. 5



boric oxide glass, the other colorless glasses are largely similar; highly transparent to 2.6 microns, less transparent to 4 microns, little transparency at 5 microns. Most basic oxides deepen the absorption bands at 2.9 microns and 3.6 microns, or make them overlap. For boric oxide glasses, strong absorption bands are present from 2.8 microns on, causing considerable absorption beyond 3.5 microns.

Considerable work has been done on the relation between absorption and the temperature of the absorbing glass. Weizel and Wolff[9] photographed the spectrum of a carbon arc after the radiation had passed through a container of commercial glass composition. The temperature of the containers could be varied from 0 to 500°C. The intensity of the transmitted radiation and hence the percentage absorption could be obtained from the photographic plates. After a study of the results obtained by varying the temperatures and the glass composition of the containers, it was concluded that the absorption of radiation for a given glass increased as the temperature increased.

Holland and Turner[10] have concluded that glasses usually show a small increase in the index of refraction as the temperature increases up to the "transformation point," that increasing temperature causes the transmission curve to be shifted slightly toward the red region, and that increasing temperature causes increased absorptivity.

III. Preparation and Testing of Glasses

The base glass prepared was of the soda-lime-silica type, similar in composition to the majority of commercial glasses. The raw materials for this base glass were Ottawa glass sand, C. P. sodium carbonate, and C. P. calcium carbonate. The amounts used in the glass batch were: sand—1205.6 grams, sodium carbonate—494.8 grams, and calcium carbonate—299.6 grams. The composition of a glass prepared from the above batch should be: SiO_2 72.5%, Na_2O 17.4%, and CaO 10.1%. This batch was mixed thoroughly, placed in a fire-clay crucible, heated in a gas-fired furnace until the melting process was observed to be complete, quenched by pouring into water, dried, and then ground in a ball mill until all the glass passed through a 100-mesh screen. The iron content (expressed as per cent Fe_2O_3) of this base glass was found to be 0.006%.[11]

The oxides chosen for addition to the base glass were those ionic colorants ordinarily used to color glass, as well as several others deemed to be of sufficient interest to include in this investigation. Three rare-earth oxides —neodymium oxide, praseodymium oxide, and samarium oxide—were obtained from the Department of Chemistry, University of Illinois, and also used as coloring oxide additions. Manganese dioxide was one of the coloring oxides originally used. Unfortunately, consistent results with regard to intensity of color could not be obtained with this oxide, and so the results are not included.

Varying amounts of the coloring oxides were added to exactly ten grams of the powdered base glass. The

[9]W. Weizel and H. W. Wolff, "The Relation of Temperature to Absorptive Power in Certain Glasses in the Ultraviolet," Z. tech. Physik. *11*, 358-61 (1930).

[10]A. J. Holland and W. E. S. Turner, "The Transmission in the Visual Spectral Region at Temperatures from 20° to the Softening Point," J. Soc. Glass Tech., *25*, 164-220 (1941).

[11]Chemical analysis by the Department of Chemistry, University of Illinois, Urbana, Illinois.

coloring oxides used in the glasses, the proportions added, and the formulas of the additions are given below:

Element Added	Oxide Addition	Proportion: Wt. of the oxide addition expressed as a percentage of wt. of the base glass. Series 1 %	Series 2 %	Series 3 %
V	V_2O_5	0.500	1.000	2.000
Cr	Cr_2O_3	0.100	0.200	0.500
Cu	CuO	0.500	1.000	2.000
Fe	Fe_2O_3	0.500	1.000	2.000
Co	Co_3O_4	0.020	0.050	0.100
Ni	Ni_2O_3	0.100	0.200	0.500
Nd	Nd_2O_3	1.000	2.000	5.000
Pr	Pr_6O_{11}	1.000	2.000	5.000
Sm	Sm_2O_3	1.000	2.000	5.000
U	U_2O_3*	0.500	1.000	2.000

*Note: Actually added as uranyl nitrate.

In nearly all cases, the oxide additions were of the reagent type and warranted to be chemically pure. The following exceptions should be noted:

U_2O_3: This oxide was supplied to the glass batch by means of a chemically pure uranyl nitrate addition. A suitable correction was made.

Pr_6O_{11}: Consisted of 85% Pr_6O_{11}, 5% Nd_2O_3, and 10% miscellaneous oxides, including lanthanum oxide. A suitable correction was made to insure that the correct addition of Pr_6O_{11} was made.

Sm_2O_3: Consisted of 95% Sm_2O_3, 2% Nd_2O_3, and 3% miscellaneous oxides. A suitable correction was made to insure that the correct addition of Sm_2O_3 was made.

The accuracy of weighing was $\pm$ 0.0001 gram. The balance weights used were checked against a series of standard balance weights and found to be sufficiently accurate.

The base glass and the oxide addition were thoroughly mixed by hand on a sheet of paper, the mixture transferred to a platinum crucible, and the crucible placed into an electric globar furnace, equipped with automatic temperature control, that had previously been heated to 1400°C. The crucible remained in the furnace for not less than one hour, and was then removed from the furnace and plunged into water. The glass was then removed from the crucible and dried in a small electrically-heated drier. Seven grams of the dried glass were placed in a platinum-rhodium crucible, and the crucible transferred to the globar furnace at 1400°C. After not less than two hours melting time, the crucible was removed from the furnace and allowed to cool in the air. The glass separated itself from the crucible and could be removed in the shape of a disc. These discs were examined visually, and those with imperfections of any consequence were remelted. After a sufficient number of good discs were obtained, they were annealed and then examined in a strain-finder using polarized light. All discs were found to be annealed satisfactorily (Grade No. 1, GCA standard annealing discs).

Each disc was then ground down by hand until a flat disc of uniform thickness and surface texture was obtained. The thickness of each disc was 2.00 $\pm$ .01 mm.; the diameter about 26 mm. The polishing was done on a felt polishing wheel with tin oxide as the abrasive. The finished glass surfaces had a well-polished appearance.

Three different instruments were used in the determination of the spectral transmission of the prepared glasses; each instrument was suitable for measurements in a par-

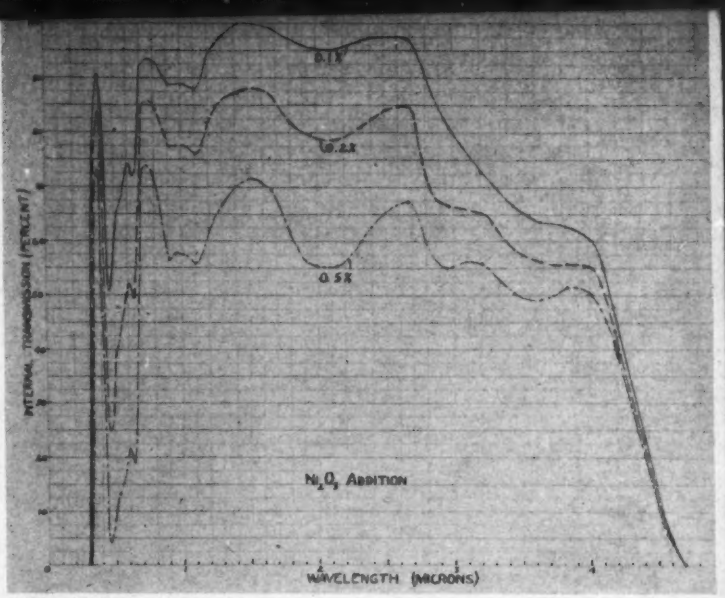


Fig. 7

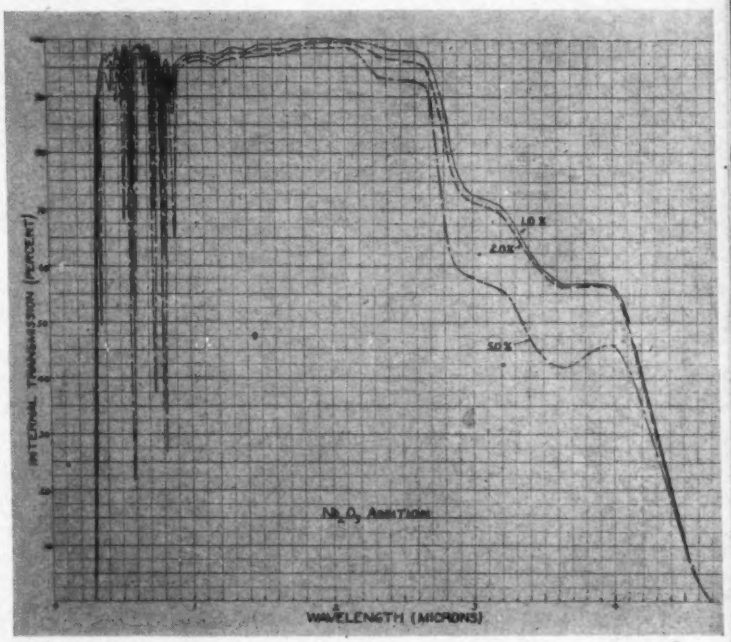


Fig. 8

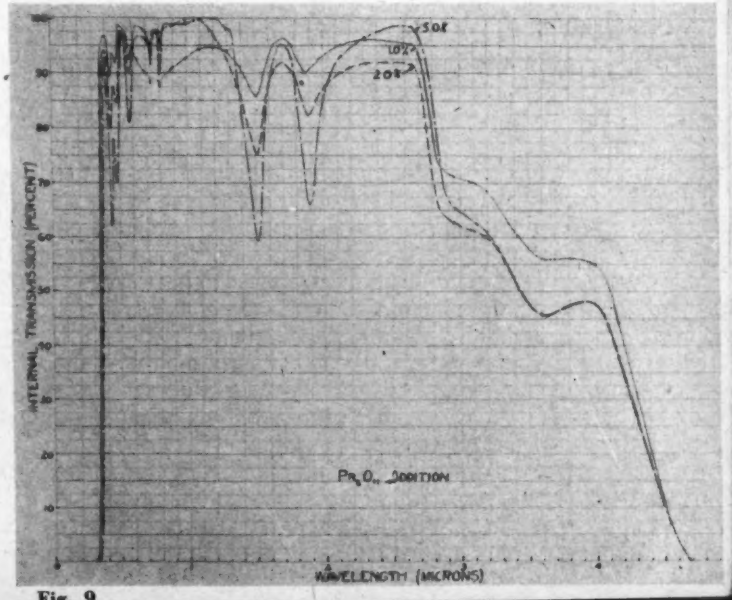


Fig. 9

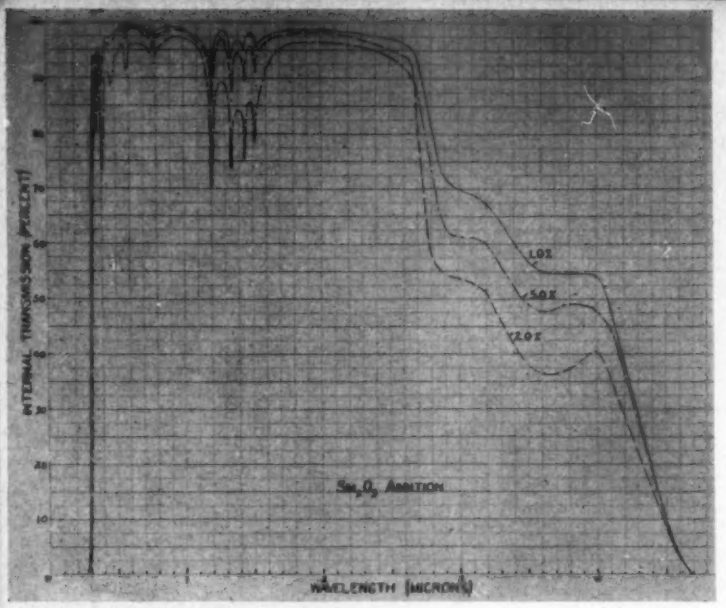


Fig. 10

ticular portion of the spectrum. The ultraviolet (200 to 400 millimicrons) and a part of the infrared spectrum (700 to 1200 millimicrons) were studied by means of a Beckman spectrophotometer. The visible spectrum (400 to 700 millimicrons) was studied by means of a Hardy-General Electric recording spectrophotometer. Both transmission and reflection measurements were made with this instrument. The remainder of the infrared spectrum (wave lengths longer than 1200 millimicrons) was studied by means of a Perkin-Elmer infrared spectrometer equipped with a recorder.

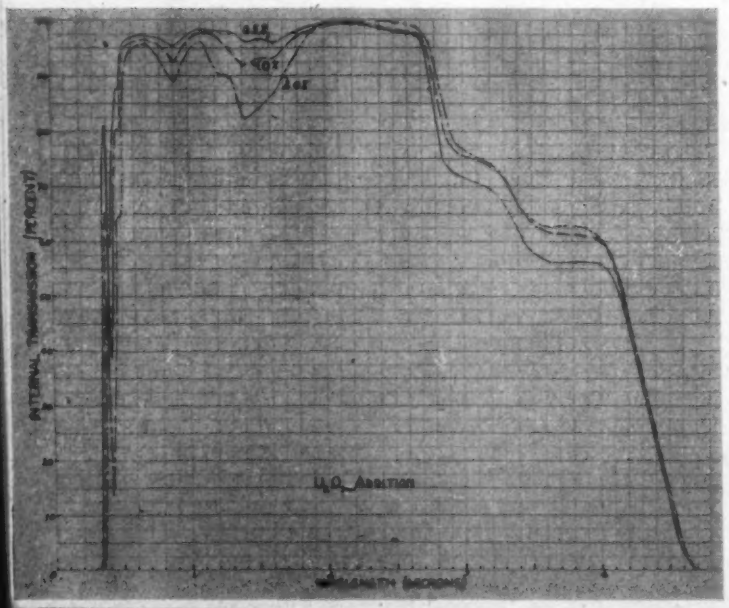
IV. Data

The data are presented in graphical form as Figures 1 to 11 inclusive, and are corrected for reflection losses.

V. Discussion of Results, and Conclusions

The absorption bands exhibited by the glasses fall into one of three classifications: (a) The band due to the structure of the glass itself. The effect of this band is to cause little change in percentage transmission between 3.5 and 4.0 microns, and in some cases there is even less transmission at 3.5 microns than at 4.0 microns. This band is present in the base glass and also in fused silica, so it is evidently not caused by the coloring oxides, although it can be, and is, modified by them. Furthermore, this band is present unchanged in all specimens of silica glass prepared under a wide variety of conditions,[12] so it can be considered to be characteristic of the glass-forming oxides themselves. (b) An absorption band with maximum absorption at about 2.9 microns. This band was present in all our glasses. It is present also in untreated Pyrex-brand chemical glass, but absent or nearly absent in degassed Pyrex-brand chemical glass.[12] It is present to a variable extent in silica glass, depending on the method of manufacture. Water vapor has a very strong absorption band at 2.70 microns and liquid water has a much broader band with its center at 3.0 microns. It may be concluded, therefore, that this band is due to the water content of the glass. It has been known for some time that the degassing of an ordinary glass yields a considerable quantity of water vapor. It is not surprising, therefore, that this "bound" water exerts considerable influence on the infrared absorption of a glass. (c) All absorption bands at wave lengths less than about 2.6 microns. These may be considered as due to the "electronic" absorption of the atoms of the coloring oxide, a phenomenon which has been described previously in this paper.

Fig. 11



The glasses containing Cr_2O_3 and CuO have similar over-all absorption patterns, while the absorption patterns of Fe_2O_3, Ni_2O_3, and Co_3O_4 are somewhat similar to one another, as might be expected from a consideration of their quite similar electronic configurations.

The rare earth oxides—Nd_2O_3, Pr_6O_{11}, and Sm_2O_3—exhibit the sharp absorption bands characteristic of the rare earth elements. Nd_2O_3 was present as an impurity in both the Pr_6O_{11} and the Sm_2O_3, and absorption bands at 740 and 810 millimicrons in the infrared, 583 millimicrons in the visible, and 360 millimicrons in the ultraviolet are due to the presence of Nd_2O_3. Praseodymium, as well as neodymium, has an absorption band at 583 millimicrons, so the absorption band at 583 millimicrons observed with the Pr_6O_{11} is due to both the Pr_6O_{11} and the Nd_2O_3 impurity in the Pr_6O_{11} addition.

The position of the infrared cut-off for all glasses tested was at approximately 4.7 microns.

The ultraviolet cut-off for the base glass was at 280 millimicrons. No other glass had any transmission at wave lengths less than this figure, and in many cases the cut-offs were at wave lengths greater than 280 millimicrons, depending on the coloring oxide used and the amount of that oxide added to the base glass.

Co_3O_4 was found to be the most powerful absorbing agent per unit weight in the infrared as well as in the visible region. Ni_2O_3 is also a better absorbing agent per unit weight than Fe_2O_3 in the infrared region of the spectrum. However, both Co_3O_4 and Ni_2O_3 additions had high absorption in the visible region also. Fe_2O_3 is the only oxide addition that combined high infrared absorption with a relatively low absorption in the visible region.

CuO and Cr_2O_3 are the best absorbers in the near infrared region (adjacent to the visible spectrum).

Cr_2O_3 is the best absorber in the ultraviolet. The glass

(*Continued on page* 652)

[12]Anna J. Harrison, "Effect of Water Content on Infrared Transmission of Simple Glasses." Paper read before Glass Division at the Forty-eighth Annual Meeting of the American Ceramic Society, 1946.

ANNUAL MEETING OF THE OPTICAL SOCIETY

The glass technologist found items of interest in the Optical Society's meeting in Cincinnati. Sessions devoted to microwave optics and aerial photography, a paper on a light polarizing coating, and a paper on a camera capable of photographing at a rate equivalent to 5,000,000 frames per second were high-lights of the meeting.

The method of producing polarized light by means of coating a glass surface with a dichroic solution appears to be science's newest glamour item. John F. Dreyer of General Polarizing Company presented the subject in a paper entitled "A Variable Light Polarizing Coating." This process depends upon the ability of the dichroic solution to retain on drying an orientation determined by the surface character of the glass. The surface character of the glass can be altered at will by rubbing previous to the treatment. The method can be used to determine the process through which a finished glass item had passed. Many interesting points were demonstrated, such as linear motion similar to wave motion by rotation of one plate.

The other paper, which proved to be very popular was Dr. O'Brien's and Gordon G. Milne's paper, "Application of an Image Dissection Principle to High Speed Motion Photography." Dr. O'Brien described the difficulties encountered by previous investigators attempting to photograph motion at high speeds and the limits which had previously been achieved. The present work has resulted in a camera, which by photographing the image as a series of displaced slits and then rephotographing at a slower speed by "playing back" the dissected image, results in a speed equivalent to 5,000,000 frames per second. Actual photographs of spark discharges, arcing and the flight of a rifle bullet were shown. Present investigation indicates that even higher speeds can be obtained.

In sessions devoted to general optics, A. Marechal of the Institute d'Optique of Paris presented a theoretical paper, "Study of Diffraction Patterns in Presence of Various Aberrations." This was followed by some interesting pictures by Dr. Zernicke showing the solution of a similar problem by experimental methods. A paper by Franklin S. Harris, Jr. of the University of Utah showed the methods which they have developed to photograph the diffraction patterns. They have employed the new zirconium oxide concentrated arc to obtain pictures with much shorter exposures. Two interesting papers on interference filters were: "An Interference-Type Heat Reflecting Filter" by A. F. Turner, and "Frustrated Total Reflection Interference Filters" by Paul Leurgans and A. F. Turner of Bausch and Lomb Optical Co. In the first a very satisfactory heat reflecting filter employing gold films was described. The filter is not free of color in the visible but is usable and has the additional property of being less likely to fracture than a heat absorbing filter. The paper on frustrated total reflection filters described a filter in which the peak transmittance is independent of the half-width and in which the half-width can be made very small.

For those interested in color problems, Jack Forrest, Norbert J. Kreidl and Tyler G. Pett of the Bausch and Lomb Optical Co. presented a paper, "Color Variations in Glasses Containing Iron" describing the location in color space of the iron oxide colored glasses. This paper showed the locus of the glasses containing iron oxide in color space. In a space of ICI chromaticity and transmission it was shown how the glasses with increased iron oxide concentration rapidly drop in transmission in the direction of the yellows, and with increased reduction also rapidly drop in transmission, but in the direction of the blues. The determination of these data immediately shows the corrections to be applied to melts falling off specification. It also permits the writing of more logical color specifications for production limits.

A. E. Jacobsen of Titanium Division, National Lead Co. in a paper "Non Adaptability of the ICI System to Some Near-Whites which Show Absorption in the Far Blue Region of the Spectrum," pointed out that the present ICI system does not have the proper spectral distribution in the blue, resulting in colors on which the eye and calculated results disagree.

Of interest to the lens designers were several papers. Mr. Herzberger of Kodak Research Laboratories presented, "Contributions of the Single Surfaces to the Image Errors" in which he gave a much simpler method of computing lenses. This paper invoked much comment particularly from supporters of the conventional methods. Stephen W. Stark of Optical Research Laboratory presented the paper "Computation of Paraxial Coefficients of an Optical System." This paper pointed out that by means of some of Herzberger's methods, computation could be simplified. Robert E. Hopkins and Walter Siegmund of the University of Rochester presented a paper "Aspheric Corrector Plate for a Refracting Optical System." This paper described a corrector plate for a system using infrared radiation. In terms of the visible spectrum the plate appeared to be unsatisfactory, but for the use for which it was designed, and considering the fact that it was made by molding, the plate was considered satisfactory. "Some New Techniques in Prism Refractometry" by P. T. Scharf of Kodak Research Laboratories showed how the method of double minimum deviation could be applied to measurement of refractive indices in the infrared and ultraviolet.

Recent meetings have indicated the interest which is presently being shown in phase-microscopy. Joseph Magliozzi's (Bausch and Lomb Optical Co.) paper, "Contrast Effects of Phase Changing Elements in Microscopy" indicated that the benefits which are to be obtained from phase microscopy could be obtained with elements which can be attached to the regular microscope, eliminating the necessity of a special instrument.

Other papers of possible interest to the glass people were "The Absorption-Emission Pyrometer" by Donald H. Jacobs and Seymour Scholnick; "Projection Screens for Home Television Receivers" by R. R. Law; "An Instrument for Evaluation of Abrasion-Resistance of Thin Films" by D. M. Packer; and "Optical Finishing of KRS Materials" by Frank Cooke. Optical people will also be interested in a series of papers devoted to micro-

(*Continued on page* 660)

REDUCTION OF SODIUM SULFATE IN GLASS MANUFACTURE

The original of a paper which appeared in the Russian journal, *Glass and Ceramic Industry*.

Because sodium sulfate is mined in Russia in enormous amounts and with great ease (surface mining), it is used there on a larger scale than in U.S. In particular, sodium is introduced in the glass batch mainly as sodium sulfate instead of calcinated soda. N. I. Kitaigorodskii, G. G. Sentyurin and V. A. Rishina, *Stekolnaya i Keramicheskaya Promyshlennost* (Glass and Ceramic Industry), 1947, No. 4, p. 6, studied the reaction between sodium sulfate and the other batch constituents.

Glass making on the basis of sodium sulfate is more difficult than on the basis of soda ash. The two main disadvantages are enhanced corrosion of the refractories of the glass furnace and slowness of the glass formation.

The batch including sodium sulfate contains, in addition to the usual batch constituents, a reducing agent. Kitaigorodskii et al. believe that the above disadvantages are, at least partly, due to combustion of the reducing agent. Because of this burning out, much sulfate remains un-reduced and forms a melt which is poorly miscible with the silicate and corrodes the refractories. The waste of the reducing agent can be demonstrated by the following experiment. A batch containing sodium sulfate and an amount of wood charcoal which, in theory is more than sufficient for reducing the sulfate, is heated to 1100°C (2012°F). It still contains undecomposed sulfate. Then an additional amount of charcoal (2 lb. for every 100 lb. of the sulfate originally present) is added, and the mixture is again heated to 1100°. The percentage of undecomposed sulfate remains almost unaltered, and is scarcely affected also if another 2 per cent of charcoal is added and the heating to 1100° repeated.

The utilization of the reducing agent depends on its particle size. Wood charcoal having grains of 0.49 mm., 0.385 mm. and 0.10 mm. (0.019, 0.015 and 0.004 in.) was tried out, and the best results were obtained with 0.385 mm. particles. However, the improvement was not serious enough, and several alternative reducing agents were tested.

The batch used consisted, e.g., of sand 72.35, alumina 1.89, chalk 10.50, magnesia 3.50, borax crystals 2.46, sodium sulfate 37.82, and reducing agent 2.27 parts. It was aimed to obtain glass consisting of SiO_2 71.5, Al_2O_3 1.65, Fe_2O_3, 0.10, CaO 5.64, MgO 2.87, B_2O_3 1.00, Na_2O 16.50 and SO_3 0.38%. As reducing agent, wood charcoal, electrode carbon, anthracite, coke, and mixtures of these materials with each other and with silicon carbide were used. The mixtures were heated to 1100, 1200, 1300 and 1350°C (2012°, 2192°, 2372° and 2462°F), apparently to nearly constant weight, and the loss of weight determined. A greater loss of weight indicates a greater extent of reduction of the sulfate. The batches were heated in unglazed porcelain crucibles. Table I shows the results obtained.

TABLE I

Loss of weight (%) of sulfate batch as a function of the reducing agent.

Reducing agent	Temperature 1100°C	1200°C	1300°C	1350°C
Wood charcoal	7.80	9.70	13.50	17.02
Electrode carbon	7.90	9.85	14.05	18.25
Anthracite	8.05	10.05	15.20	19.10
Coke	8.20	10.28	16.90	21.40
Wood charcoal + 2% of SiC	8.25	10.40	17.05	21.45
Wood charcoal + 10% of SiC	8.35	11.10	18.20	23.00
Wood charcoal (2 parts) + electrode carbon (1 part)	8.46	11.20	18.95	23.10
Wood charcoal (2 parts) + anthracite (1 part)	9.40	11.90	19.70	23.60
Wood charcoal (1 part) + anthracite (1 part)	9.50	12.60	20.03	24.01
Wood charcoal (2 parts) + coke (1 part)	9.75	13.00	20.51	24.60
Wood charcoal (1 part) + coke (1 part)	9.90	13.80	20.95	25.10

It is seen that the 1 : 1 mixture of wood charcoal and coke yields the most complete reduction.

The above-mentioned batch containing the 1 : 1 mixture of wood charcoal and coke was used for making experimental glass samples of 300 g. each. The temperature of the experiment was 1450°, and the glass was kept at this temperature for 3 hours. The color and uniformity of the glass obtained were quite satisfactory.

NEW COLORADO SAFETY GLASS LAW IN EFFECT

The new statute passed by the last Colorado State Legislature requiring safety glass in all new motor vehicles and banning the replacement of glass with other than safety glass will go into effect January 1, 1948.

After that date the state forbids the sale of a new motor vehicle and will not register a new motor vehicle unless it is equipped with safety glass wherever glass is used in doors, windows or windshields. Safety glass is also required in all replacements of any glass used in doors, windows or windshields.

One section of the law which concerns busses has been in effect since May, 1947. This section prohibits sale or registration of any new vehicle designed or used for the purpose of transporting passengers for compensation or as a school bus, unless it is equipped with safety glass wherever glass is used in doors, windows or windshields. Replacement of safety glass with other than safety glass was also prohibited in this section.

In the law, safety glass is defined as any product composed of glass, so manufactured, fabricated or treated as to substantially prevent shattering and flying of the glass when struck or broken or such other or similar product.

The Colorado State Highway Department, Denver, will publish a list of the types of glass by name which have been approved as meeting the requirements of the law.

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Glass Compositions

General Electric Glass Composition. Patent No. 2,429,-432. This patent is directed to a glass composition particularly adapted for use in electric lamps, valves and such devices. It is the invention of John E. Stanworth of Sheffield, England, who assigned it to General Electric Company.

It is well known that glass for such use must be easily workable and be suitable for sealing with lead-in conductors. It has been usual to use lead oxide in the batch in order to achieve these objects but this has had certain objections which are overcome by this invention. This invention proposes a glass composition coming within the following range in per cent by weight:

Silica + boric oxide	56-64
Oxides of barium, strontium, magnesium, zinc, calcium	22-30
Oxides of sodium and potassium	10-17
Fluorine	0-5

This glass is particularly adapted for use in making the tubing used in forming the stems into which the leads of lamps and valves are sealed. A more specific composition for this purpose is as follows:

Silica + boric oxide	58-62
Oxides of barium, strontium, magnesium, zinc and calcium	24-28
Oxides of sodium and potassium	12-15
Fluorine	0-2
Boric oxide, per cent maximum	10
Barium + strontium oxides, do	20
Magnesium oxide, do	10
Zinc oxide, do	10
Calcium oxide, do	5

There were no references cited by the Patent Office during the prosecution of this application so far as is shown by the patent.

Titanium Fluophosphate Glass. Fig. 1. Patent No. 2,430,539. This glass composition is the invention of Kuan-Han Sun of Rochester, N. Y., who assigned it to Eastman Kodak Company. This glass may be classified as a flint glass, or if only a small amount of titanium is used, as a crown glass. Of course it's primarily of value as an optical glass.

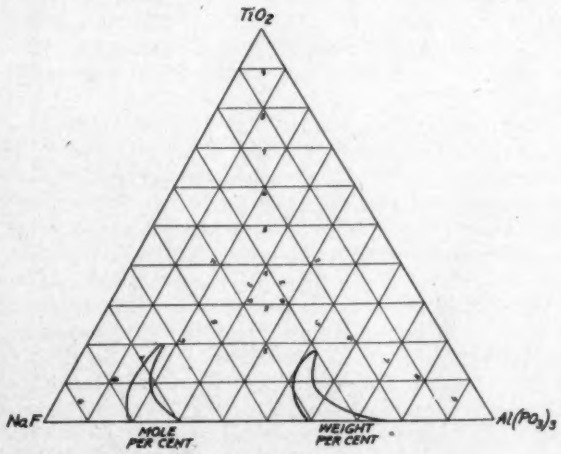


Fig. 1. Titanium Fluophosphate Glass.

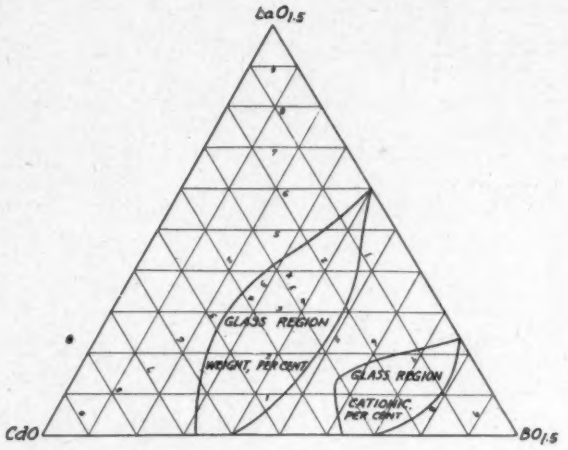


Fig. 2. Cadmium-Lanthanum-Borate Glass.

The ternary diagram in Fig. 1 shows the glass-forming region both in weight and mole percent of a system comprising sodium fluoride, titanium oxide and aluminum metaphosphate. The glass forming regions shown here should not be taken as exact. This is the equivalent of a four-component system NaF-TiO_3-$AlO_{1.5}$-$PO_{2.5}$ but this can not be represented in a ternary diagram.

In the following table are given several examples with both the weight and mole percentages and also the index of refraction for the D line, the Abbe value, the blue partial dispersion ratio, and the F/P ratio.

Example	1		2		3		4		5	
	W	M	W	M	W	M	W	M	W	M
NaF	38	77.0	34	72.8	40	75.1	36	70.7	30	62.9
TiO_2	4	4.3	6	6.8	10	9.9	13	13.4	18	19.8
$Al(PO_3)_3$	58	18.7	60	20.4	50	15.0	51	15.9	52	17.3
n_D	1.4820	....	1.5092	....	1.5142	....	1.5490	....	1.6084	....
v	53.1	....	47.1	....	40.1	....	35.1	....	30.2	....
v_{gF}	0.571	....	....	....	0.598	....	0.609	....	....	....
F/P	1.38	....	1.12	....	1.68	....	1.48	....	1.21	....

Several other examples are given in the patent, showing slight variation in the ingredients. In making these glasses, the powdered and dried materials are mixed thoroughly and placed in a covered platinum vessel. Melting is done at about 1000° C., and a 50-gram melt is ready in about 25 minutes. As soon as the batch is liquid, the temperature may be lowered and the glass is stirred. It is then poured into molds which have been heated to about 350-450° C. It is noted that no references were cited by the Patent Office during the prosecution of this application.

Cadmium-Lanthanum-Borate Glass. Fig. 2. Patent No. 2,430,540. This invention is on an optical glass having a high refractive index and a moderate Abbe value. It was invented by Kuan-Han Sun and Thomas E. Callear who assigned it to Eastman Kodak Company.

Glasses of this type are usually made of expensive material but these inventors have found that a cheaper satisfactory glass may be made by the use of cadmium. The boundary lines of glass formation region of the system

CdO-$LaO_{1.5}$-$BO_{1.5}$ are shown in Fig. 2 for both weight per cent and cationic percent.

The following table gives three illustrative examples of glasses with their batch compositions in weight percentages (W) and cationic percentages (C):

	1		2		3	
	W	C	W	C	W	C
CdO	41	25.6	34	22.1	31	18.8
$LaO_{1.5}$	34	16.8	33	16.9	35	16.7
$BO_{1.5}$	25	57.6	24	57.6	28	62.7
ThO_2	....	....	....	....	6	1.8
$TaO_{2.5}$	....	....	9	3.4	....	....
n_D 1.7895		....	1.8132	....	....	....
	44.4	....	42.5	....	....	....

The index of refraction for the D line (n_D) and the Abbe value (μ) are given for two of the examples.

In making these glasses, the batch in powdered form is mixed uniformly and melted in a platinum vessel at about 1200 to 1300°C. About half an hour should be sufficient to melt about 100 grams. The glass is then stirred and poured into a heated mold. A clear, colorless glass is obtained which resists attack by moisture.

This patent shows that no references were cited by the Patent Office during its prosecution.

Miscellaneous Processes

Method of Staining Glass with Copper. Patent No. 2,428,600. This patent is the invention of Helen S. Williams, State College, Pa., who assigned it to Glass Science, Incorporated, of New York. Red glass can be obtained by the use of copper in two ways. In one method of making copper ruby, the copper compound is introduced into the glass batch which produces a deep ruby color when reheated. In the other method, the glass is first coated with a mixture containing a copper compound, firing in an oxidizing atmosphere to cause the copper to replace alkali in the glass and then firing under reducing conditions to produce a red glass. This staining method is not well adapted for use with soda lime glass such as bottle and window glass.

This invention provides for treating the hot glass surface with volatile copper salts which produces the desired color in ordinary soda lime glass. The vapors of both cupric and cuprous handles can be used.

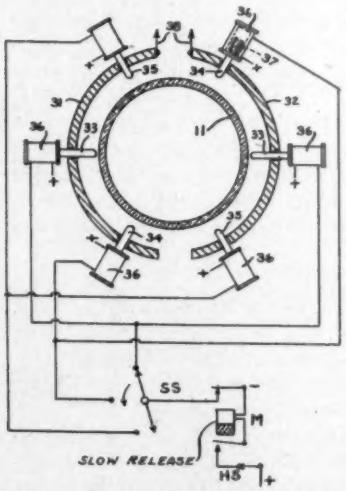


Fig. 3. Corning Glass Heating Device.

In carrying out the method of this invention, one way is to heat the glass to about 500° C. in a cuprous chloride atmosphere for a length of time varying from 15 minutes to 8 hours. In this way the copper ions are introduced into the glass surface by a base exchange reaction with the sodium ions of the glass. If the amount of cuprous ions is sufficiently great, a mirror may be produced. For this purpose the reduction is carried out at a temperature of from 700 to 800° C., by flash reduction with hydrogen of glass which has been exposed to cuprous chloride vapors for 6 hours at 550° C. The mirror thus formed is within the surface of the glass and does not dissolve in nitric acid. By regulating the amount of copper, and reducing at a temperature of from 400 to 500° C., a ruby or metallic luster may be obtained.

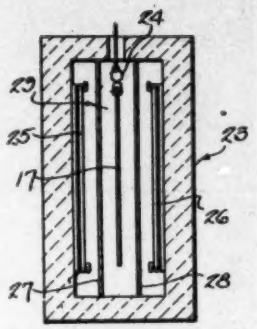


Fig. 4. Electrically Conducing Coating on Glass.

Five examples are given to illustrate the invention, one of which is as follows: A normal soda lime glass was exposed to cuprous chloride vapor for 6 hours at 550° C., and had a light blue color before reduction. After reduction in hydrogen at 460° C., it had a dark red color and a pronounced metallic reflection.

The following references are of record in the file of this patent: United States Patents: 1,183,109, Parsche, May 16, 1916; 1,372,258, Tomlinson, Mar. 22, 1921; 1,497,417, Weber, June 10, 1924; and 1,816,476, Fink et al., July 28, 1931.

Corning Glass Heating Device. Fig. 3. Patent No. 2,428,969. The object of this invention is to heat a band around a tubular piece of glass so that the heated strip may be worked and shaped. It is the invention of Edwin M. Guyer who assigned it to Corning Glass Works.

It has been common to heat a band around a tube by providing two electrodes, one to introduce the current into the glass and the other to take it off, while revolving one or the other. This invention provides means for heating such a band without the necessity of relative motion between the electrodes and the glass.

As shown in Fig. 3, which is one embodiment of the invention, the glass article 11 is surrounded by bus bars 31 and 32 supplied with current from conductors 38. Pairs of electrodes 33, 34 and 35 are movable into and out of contact with the glass by means of springs 37 and solenoids 36. Current is supplied to the proper solenoids by a switch SS through a retarded action magnet M when the hand switch HS is closed. The article 11 having been preheated to a conducting temperature, when the first pair of electrodes 33 are put in effect, an equal amount of current passes in opposite directions from this electrode. When the next pair of electrodes 34 are brought into heating relation, that half of its periphery between the electrodes 34 in the direction of scanning includes two-thirds of the circumference previously between electrodes 33. The remaining half of the periphery includes only one-third of the periphery previously between the electrodes 33. This gives an interlacing effect whereby a part of the previously heated surface is included in the surface next heated. It will be apparent that the same general idea may be used with non-circular glass objects.

The following references are of record in the file of this patent: United States Patents: 2,306,054, Guyer, Dec. 22, 1942; 916,959, Cummins, Mar. 30, 1909; 2,286,210, Klemperer et al., June 16, 1942; 722,701,

Hanks, Mar. 17, 1903; and 1,589,235, Schroder, June 15, 1926.

Electrically Conducting Coating on Glass. Fig. 4. Patent No. 2,429,420. This is the invention of Harold McMaster of Toledo, Ohio, who assigned it to Libbey-Owens-Ford Glass Company. The object of the invention is to produce a thin transparent coating of conducting material on glass or other similar surfaces. Such a coating may be used in burglar alarms, heating elements and electrical resistors. It is particularly useful on the windows of airplanes at high altitude where the electrical heating de-ices the glass.

The general idea of the invention is in the discovery that tin chlorides, including hydrated stannous chloride and hydrated stannic chloride, can be used to produce thin transparent conducting coatings on glass and other vitreous surfaces. In order to produce such a coating, the tin chloride must be applied in the presence of a carefully controlled amount of water.

To carry out this method, the glass is heated to the softening point and then immersed in a liquid composed of 1 part glacial acetic acid, 1 part absolute alcohol and two parts stanic chloride which has been heated until the boiling point is between 120 and 130° C. The glass is allowed to remain in this liquid for only a few seconds and is then removed and allowed to cool in open air.

The film thus produced is very hard. The light transmission of a half wave length film is about 92% and the resistance is about 200 ohms between parallel spaced by a distance equal to their length.

Fig. 4 shows one method of heating the glass, in which the sheet 17 is suspended in a furnace 23 by small hooks or tongs 24. The furnace is heated by electrical heating units 25 and 26 in front of which are baffle plates 27 and 28 which form a heating chamber 29. After heating to about the softening point, the glass is immersed in a tank containing the above described coating fluid for a few seconds. The coating thus formed is useful anywhere that clear vision is required under adverse weather conditions such as aircraft carriers, airport control towers, lighthouses, etc.

The following references are of record in the file of this patent: United States Patents: 597,806, Marangolo, Jan. 25, 1898; 1,588,510, Wear, Aug. 25, 1923; 1,644,798, Tillyer, Oct. 11, 1927; 1,941,438, Kiefer, Dec. 26, 1933; 1,964,322, Hyde, June 26, 1934; 2,021,661, Kisfaludy, Nov. 19, 1935; 2,026,086, Farncomb, Dec. 31, 1935; 2,118,795, Littleton, May 24, 1938; 2,281,474, Cartwright, Apr. 28, 1942; and 2,303,871, Walker, Dec. 1, 1942. Foreign Patents: 539,621, Great Britain, Sept. 18, 1941.

Glass Cutter. Fig. 5. Patent No. 2,430,349. This patent provides a glass cutter for cutting safety glass made by combining two sheets of glass with a sheet of plastic material between. It is the invention of Lucien Lefebvre of Timmins, Ontario, Canada. The invention provides means for scoring both sides of the glass equally without regard to the shape of the piece to be cut.

As shown in Fig. 5 a frame 10 is formed by members 11 and 12 including handle members 19 and 20. A knurled knob 57 provides means for adjusting the tension of a spring 62 which holds the working ends of the arms together. The ends of these arms carry glass cutters 65 and 66 which have glass cutters 71 mounted in the ends. These are held in position by set screws 72. Thus when the handles 19 and 20 are pressed together, the cutters are separated so that they may be placed over a sheet of glass. When the handles are released the spring 62 presses the cutters against opposite sides of the glass and any desired pattern may be followed. It is obvious that the length of the arms and other parts may be varied to suit conditions.

The following references are of record in the file of this patent: United States Patents: 1,710,898, Rowley, Apr. 30, 1929; 1,807,619, Boush, June 2, 1931; 2,302,174, Boicey et al., Nov. 17, 1942; and 1,999,594, Owen, Apr. 30, 1935. Foreign Patents: 3,607, Great Britain, 1891.

Glass Tubing Machine. Fig. 6. Patent No. 2,429,220. This is an invention of Edward Danner of Newark, Ohio, who is well known as the inventor of tube drawing machines. This patent is a division of his patent application Serial No. 498,971 filed August 17, 1943 which is a continuation-in-part of his application Serial No. 235,300 filed October 17, 1938.

Heretofore difficulty has been encountered in the manufacture of glass tubing due to drawing lines which appeared in the finished product. Efforts have been made to overcome this but they have increased the cost of the tubing. This invention provides an apparatus in which the molten glass is repeatedly intercepted during its downward flow and at the same time is intermixed so as to provide a uniform temperature. This also prevents devitrification.

As shown in Fig. 6 the molten glass G is delivered to

(*Continued on page* 654)

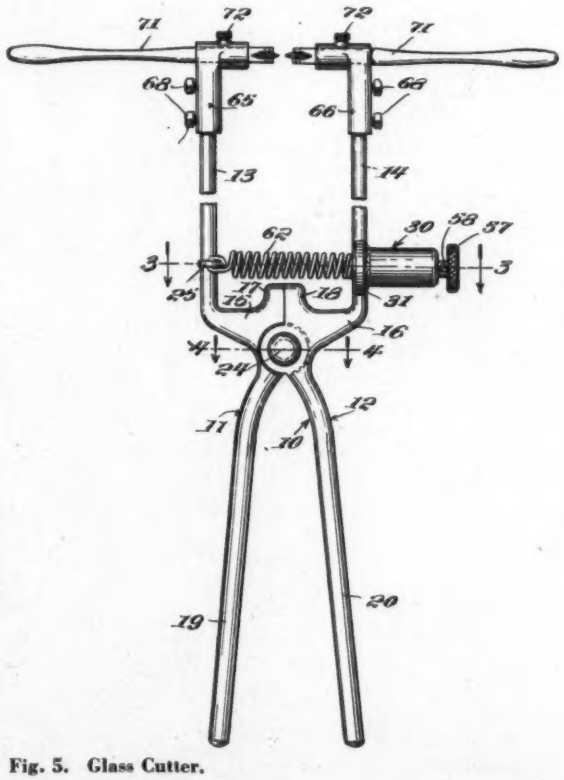


Fig. 5. Glass Cutter.

Research Digest

Convection Currents in Glass Tanks

For those who possess the ability to read technical French, the June, 1947, issue of *Verres et Refractaires* contains an excellent article by Ivan Peyches on the subject of convection currents in glass tanks. This article, while it is a general review of work performed on the subject by other investigators, approaches the subject in a logical manner and is interlaced with much taken from the author's own experiences. The following brief summary will indicate the subject material dealt with. In Part I, the author discusses and analyzes the various methods which have been used for measuring convection currents. These are classified as follows: A—Studies in Live Tanks: a) floaters, for study of surface currents, b) plungers, for study of deep currents, c) scales (after d'Opperman), for study of direct and return currents, and d) tracers such as color, composition and fluorescence, for studies on the rate of flow. B—Post Mortem Studies: a) devitrification or color patterns in the solidified glass (glass frozen in the furnace as rapidly as possible), b) erosion of tank walls and tank blocks (either natural or by patterns formed by drill holes), and c) studies by use of model tanks.

Peyches states that none of these methods if used by itself will give all the information that is required but each method or procedure will allow the derivation of basic principles. Different tank constructions affect the results obtained in one particular type of construction and results may vary in the same tank because of fortuitous factors.

In Part II, the author deals with the interpretation of the experimental facts and discusses this in the following order: A—The components of the main current: a) the pull current, usually theoretical and relatively small component, but not negligible in the case of high pulls, b) the apparent well of the current (point source), i.e., the point where the heavier glass descending at the walls resurges to the surface after regaining the central area of the tank, c) the thermal barrier at the well or point source caused by the cold material being introduced through the doghouse, d) the convection currents in the working end, e) the surface current, f) the return or counter currents, and g) the neutral zone. Illustrations and diagrams are given which show the well (or point source), the effect of thermal barriers, the path of floaters and erosion tanks in the bridgewall blocks.

B—The influence of incidental traits on the pure current scheme: a) the influence of joints, horizontal joints are preferred points of erosion and are worked by vertical wall current. Neutral zones are liable to occur at the location of such joints. The colder glass in the corroded joints is a natural well of descending currents; b) the influence of the bridgewall and throat as illustrated by diagrams and photographs which showed the effect of deep and shallow bridgewalls (i.e., throat openings or floaters) on the formation of secondary circular currents above the main convection current which passes into and returns from the working end, c) "Schilds rollers," an expression applied to those zones of cold glass which rotate in a stable location between the main current and the counter-current, d) generalizations on rollers (i.e., areas of glass rotating in a fixed location) which also exist at and are caused by submerged throats, doghouses or corners (either side to side or side to bottom), e) influence of constrictions, f) influence of spouts, g) currents due to composition, h) corrosion in the fusion zone, the vertical corrosion lines in the fusion zones which are attributed to viscous glass incapable of following the general convection current of hotter material, i) the advantages and disadvantages of convection currents. The homogeneity of the glass is increased by currents which are more intensive in larger and hotter tanks. Spouts counteract the efficiency of hot melts. Changes impressed at a certain date reactivate dead areas containing old glass. The case history of a change in iron content of a glass is described and presented graphically. The changed diathermic properties of the melt decreased the intensity of the currents. Temperature and quality data illustrated the consequences. Among the disadvantages of convection currents is listed the removal of heat (calories) from desired zones of action.

Part III of this study contains a simple theory of the dynamics of tank currents and the comparison of experimental data with the predictions of the theory.

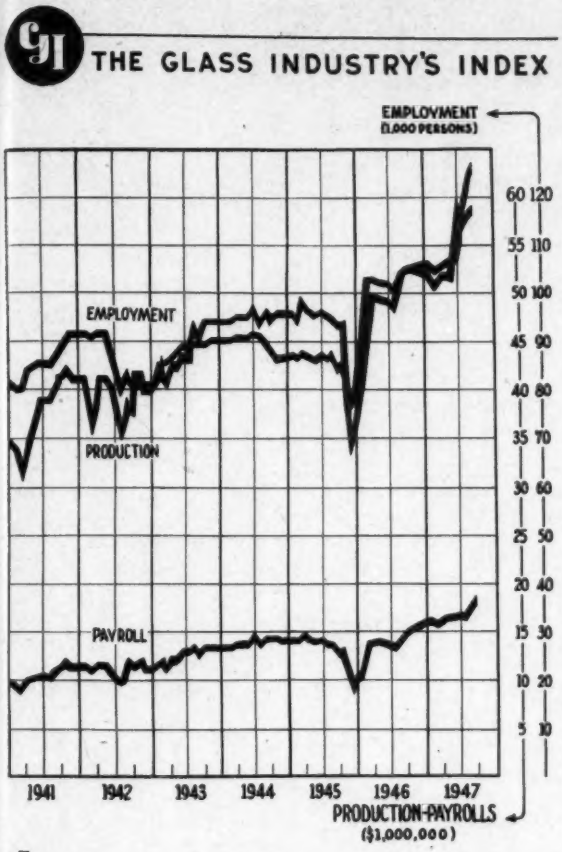
(Editor's Note: A future issue of THE GLASS INDUSTRY will contain a complete translation of Dr. Peyches' paper.)

Staining of Glass Containers in Contact with Iron

It has been observed that in the automatic washing of bottles, wet glass containers which remained in contact with iron for any length of time assumed stains which are difficult to remove even with hydrochloric acid treatments. Marboe and Weyl (*Journal of the American Ceramic Society*, October 1947) have investigated this phenomena and have found that iron in contact with wet glass surfaces (regardless of composition) will produce a chemically detectable contamination in one minute and a visible stain in ten minutes. This reaction of the glass surface with iron is galvanic in nature. Iron immersed in water sends positively charged ferrous ions into solution and leaves the metal with a negative charge. In the neighborhood of the iron, a negative electrical potential is established in the glass surface which helps to attract the positively charged ions from the solution. The stain is a result of the interaction of the glass surface and the iron ions thus leading through oxidation to the formation of an insoluble, colored ferric hydrosilicate.

The staining can be prevented by reagents which 1) prohibit the corrosion of the iron, 2) block the active centers of the silica gel and 3) produce anionic iron complexes.

CURRENT STATISTICAL POSITION OF GLASS



According to the Production Index for the month of September 1947, activity in the glass industry rose about 2 per cent to an estimated figure of $63,500,000. The figure for August was $62,500,000. Activity in the glass industry for the month of September 1946 was $54,000,000, which is about 17 per cent below September this year. Total estimated production for the three-quarter period of 1947 is $528,000,000, as compared with $437,500,000 during the corresponding period in 1946.

Employment and payrolls: Employment during the month of September 1947 was reported to be 118,600 persons. This figure represents only a slight increase over the 118,000 reported for the previous month. Employment during the month of September 1946 was about 104,000. This is about 14 per cent below September this year.

During September 1947, payrolls for the glass industry were an approximate $18,000,000, which is about 2 per cent over the $17,500,000 reported for August. During September 1946, glass manufacturers paid out an estimated total of $15,000,000, which is about 20 per cent below September this year. Thus far in 1947 payrolls have reached an estimated $148,500,000, as compared with $113,000,000 paid out during the same period in 1946.

Glass container production for the month of October 1947, based on figures released by the Bureau of Census, rose about 2 per cent to 9,642,974 gross. The previous month's figure was 9,389,852 gross. Production for the month of October 1946 was 10,532,857 gross, which is about 8 per cent above October this year. Total glass production for the January-October 1947 period has reached a figure of 98,906,720 gross, as compared with 96,795,568 gross produced during the same period in 1946.

Shipments for the month of October 1947 varied only slightly from the previous month. The October figure is 9,165,875 gross, as compared with 9,159,716 gross shipped during September. Shipments for the month of October 1946 were 10,516,340 gross, or 12 per cent above October 1947. Total shipments made thus far in

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production October 1947	*Stocks October 1947*
Foods, Medicinal & Health Supplies; Chemicals, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	2,882,409	3,047,388
	Wide Mouth	*2,985,922	2,478,841
Dairy Products		356,095	253,918
Home Canning		.....	**485,578
Beverages, Returnable		1,095,568	568,544
Beverages, Non-returnable		.....	.....
Beer, Returnable		428,927	241,093
Beer, Non-returnable		400,320	293,970
Liquors		1,062,659	278,430
Wines		287,174	152,427
Packers' Tumblers		143,900	90,186
Total		9,642,974	7,890,375

*This figure includes Home Canning.
**This figure represents Fruit Jars only.

GLASS CONTAINER SHIPMENTS

(All figures in gross)

	October 1947
Narrow Neck Containers	
Foods	822,535
Medicinal & Health Supplies	989,088
Chemical, Household & Industrials	501,219
Beverages, Returnable	956,544
Beverages, Non-returnable	.....
Beer, Returnable	375,425
Beer, Non-returnable	368,868
Liquors	1,004,376
Wines	274,729
Toiletries & Cosmetics	411,922
Sub-Total (Narrow)	5,704,706
Wide Mouth Containers	
Foods	2,104,869
Dairy Products	314,678
Home Canning	*17,428
Medicinal & Health Supplies	264,251
Chemical, Household, Industrials	87,902
Toiletries & Cosmetics	129,645
Packers' Tumblers	146,045
Sub-Total (Wide)	3,064,818
Total Domestic	8,769,524
Export Shipments	396,351
Total Shipments	9,165,875

*This figure represents Fruit Jars only.

Attention . . .

Glass Tank Operators

For Maximum Life SPECIFY

C · S · R

CAST SUPER REFRACTORY

For

Mantels, Feeder Parts, Tuckstones, Burner Blocks, Port Covers, Port Bottoms, Port Arches, Port Skews, Port Baffles, Lintels, Jambs, Bridge-wall Covers, etc.

C.S.R. *has excellent resistance to*

HIGH TEMPERATURES

CORROSION

SHRINKAGE

SPALLING

C.S.R. *is*

VACUUM CAST

ACCURATE TO SIZE

UNIFORM TEXTURE

ECONOMICAL

●

Write for Full Particulars

WALSH REFRACTORIES CORP.

High Grade Refractories for Over 50 Years

4070 NORTH FIRST STREET ST. LOUIS 7, MISSOURI

1947 are 94,323,788 gross, as compared with 96,765,649 gross shipped during the January-October period in 1946.

Stocks on hand at the close of October 1947 were 7,890,375 gross, as compared with 7,477,653 gross at the close of September and 3,905,661 gross at the close of October 1946.

Plate glass production, according to the Hughes Statistical Bureau, for the month of October 1947 rose about 11 per cent to a figure of 22,988,985 sq. ft. The previous month's figure was 20,648,053 sq. ft. Production during October 1946 was 23,270,656 sq. ft. Thus far in 1947 production has reached a total of 213,177,247 sq. ft., as compared with 170,814,531 sq. ft. produced during the first ten months of 1946.

Automatic tumbler production for the month of October 1947 rose 31 per cent from the previous month's figure of 4,688,486 dozens. The October figure is 6,134,425 dozens. Production during October 1946 was 7,762,838 dozens. Shipments for the month of October 1947 were 5,465,943 dozens, or about 8½ per cent below the September figure of 5,993,701 dozens. Shipments for the month of October 1946 were 7,657,228 dozens. Stocks on hand at the close of October 1947 were 8,868,549 dozens, as compared with 7,940,031 dozens at the close of September and 5,326,415 dozens at the close of October 1946.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware for the month of October 1947 rose about 29 per cent to a figure of 4,499,938 dozens. The September figure was 3,483,287 dozens and the October 1946 figure was 5,246,784 dozens. Total manufacturers' sales for the 12-month period ending October 1947 were 40,209,005 dozens, as compared with 47,400,772 dozens at the close of the same period in 1946.

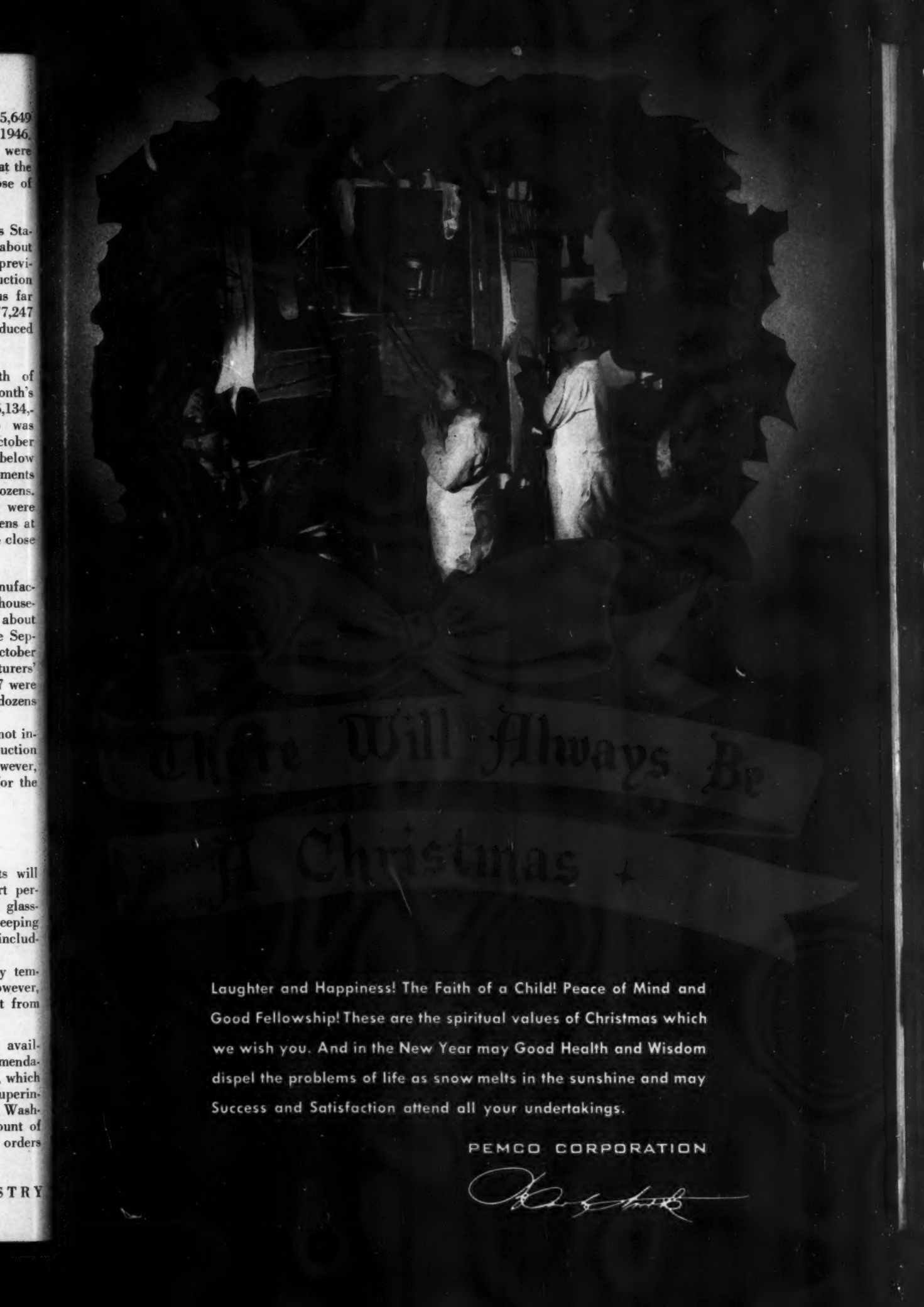
Because of lateness, one company's figures are not included in the figures for automatic tumbler production and table, kitchen and household glassware. However, the totals for this company have been estimated for the compilation of the above figures.

AFFECT OF CANADIAN IMPORT RULING ON GLASS

The recent Canadian government ban on imports will affect the American glass industry in that import permits will not be available for mirrors, vases, cut glassware, glass tableware, and ovenware. Indirectly sweeping import restrictions involve other glass products, including electric light fixtures, lamps, bulbs, etc.

Officials have emphasized that the ban is only temporary and will be lifted as soon as possible. However, Canadian experts feel that the program may last from eighteen months to two years.

● The National Bureau of Standards has made available a revision of the Simplified Practice Recommendation for Grinding Wheels. Copies of the new issue, which is designated R45-47, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 15 cents per copy. A discount of 25 per cent from the list price will be allowed on orders of 100 or more copies.



Laughter and Happiness! The Faith of a Child! Peace of Mind and Good Fellowship! These are the spiritual values of Christmas which we wish you. And in the New Year may Good Health and Wisdom dispel the problems of life as snow melts in the sunshine and may Success and Satisfaction attend all your undertakings.

PEMCO CORPORATION

LYNCH CORPORATION MERGES SUBSIDIARIES

At a special meeting of shareholders of Lynch Corporation held recently at its general office, Anderson, Indiana, it was voted by an overwhelming majority to ratify the plan of merger submitted by the Board of Directors.

The plan merges the four wholly owned subsidiaries, namely: Wiley & Lett, Inc., Lynch Manufacturing Corporation, Lynch Package Machinery Corporation and The Toledo General Investment Company, into the parent company, Lynch Corporation, as of the close of business December 31, 1947. It does not in any way affect the outstanding stock of Lynch Corporation consisting of 450,000 shares of common stock owned by some 1,800 shareholders.

Henceforth Lynch Corporation will operate its five plants, two in Anderson, Indiana, and one each in Marion, Indiana, Defiance, Ohio, and Toledo, Ohio, as one corporation, but with three separate divisions, namely: Glass Machinery Division, Par Compressor Division, and Package Machinery Division.

Executive and general offices of the corporation will be at Anderson, Indiana. Sales offices of the Glass Machinery Division will be located at Anderson, Indiana. Sales offices of the Par Compressor Division and the Package Machinery Division will be located at Toledo, Ohio. Plant Management, Engineering and Purchasing for the respective plants will be attached to each individual plant.

The merger does not contemplate any change in the directorate or executive personnel. T. C. Werbe, Sr., continues as President of the corporation, M. H. Pendergast as Executive Vice President and General Manager, and J. L. Watts as Secretary and Treasurer. F. K. Zimmerman, formerly Treasurer of all the subsidiaries with offices at Toledo, Ohio, was elected to the new post of Controller of the corporation, with headquarters in the general offices at Anderson, Indiana.

A. G. Doll, a Vice President, will be in charge of sales of the Glass Machinery Division, R. L. Sears will be Director of Sales of the Par Compressor Division, manufacturers of Par Air Compressors and Par Condensing Units. M. V. Girkins will be Director of Sales and T. C. Werbe, Jr., Sales Manager of the Package Machinery Division, manufacturers of Wrap-O-Matic Wrapping Machines and Morpac Packaging Machines. J. P. McCarthy will continue to direct the manufacturing operations of the Ohio plants, T. A. Wiley, the Marion plant, G. L. Brown, the Anderson plant, and C. Yates, the Foundry at Anderson.

THATCHER APPOINTS NEW SALESMEN

The appointment of three new salesmen has been announced by the Thatcher Glass Manufacturing Company. Leo V. Liddy has been assigned to Thatcher's New York office. Prior to his enlistment in the U.S. Air Corps, he was employed by Standard Brands, Inc.

Charles A. Adams, formerly foreign representative in South America for Bendix Aviation Corporation, has been assigned to the Philadelphia branch office, and L. Richard Bauer, formerly associated with Swift and Company, has been assigned to the Boston office. Mr. Bauer was formerly a Lieutenant in the U.S. Navy.

O-I ASSUMES OWNERSHIP OF MODERN PACKAGES, INC.

It has recently been announced that Owens-Illinois Glass Company has assumed full ownership of Modern Packages, Inc., of Memphis, Tennessee.

One of the south's well-established manufacturers of folding cartons and paper board specialties, Modern Packages, Inc., had been jointly owned by the Alton Box Board Company and American Coating Mills prior to the merger of the latter organization with Owens.

Modern Packages will be dissolved and operated as the Memphis Plant, American Coating Mills Division, Owens-Illinois Glass Company. J. C. Bruce, formerly sales manager of Modern Packages, has been appointed Plant Manager, and W. W. Finn has been named Sales Manager of the Memphis Branch.

MAYWOOD GLASS NAMES R. H. DALLAS AS SALES MANAGER

According to a recent announcement, Ronald H. Dallas has been named Sales Manager of Maywood Glass Company and the Pacific Coast Closure Division of Anchor Hocking Glass Corporation.

Mr. Dallas has had 24 years' experience in both glass container production and sales work on the Pacific Coast and has been active in the development of many new products and packages.

J. D. BIGGERS GIVEN CITATION FOR BUSINESS LEADERSHIP

John D. Biggers, President of Libbey-Owens-Ford Glass Company, was honored in New York City when a citation acclaiming him as one of America's 50 foremost business leaders was presented to him at a dinner in the Waldorf-Astoria Hotel attended by more than 1,000 business executives.

Citations were presented by B. C. Forbes as a part of the observance of the 30th anniversary of Forbes Magazine. The 50 foremost business leaders were chosen by nationwide ballot among industrial, financial, railway, insurance, utility, mercantile and other business leaders, including hundreds of thousands of readers of the magazine, it was announced.

SECTION MEETINGS OF A.C.S.

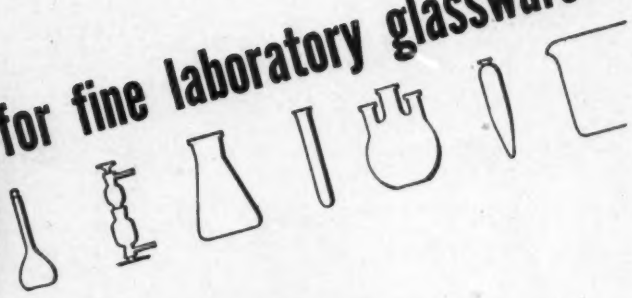
The New York Metropolitan Section of the American Ceramic Society held its first Fall meeting recently. This meeting was designated "President's Night" and the Society President, John Sullivan, attended.

Dr. James Austin spoke on "The Role of Photography in High Temperature Research," showing slides in illustration.

The Pittsburgh Section of the Society was also addressed by Mr. Sullivan at its regular monthly meeting. The section has recently announced the Albert Victor Bleininger award to be presented annually on a national basis for distinguished ceramic service.

The Northern Ohio Section held its first meeting of the season and featured speakers Homer McRae and R. J. Boyink. Mr. McRae, of North American Manufacturing Company, gave a talk on the "Fundamentals of Combustion—Gas and Oil," and Mr. Boyink, of Standard Oil Company, spoke on "Fuel Oil—Use and Availability."

for fine laboratory glassware



—YOU GET BETTER GLASS WITH SOLVAY POTASSIUM CARBONATE

The exacting requirements of laboratory glassware can only be met by special high quality glass—glass containing the finest potassium carbonate. Makers of this type of glassware, along with makers of fine table stemware, glass tubing and lenses have found that the *best* way to assure uniform high quality is to specify Solvay Potassium Carbonate.

The outstanding superiority of granulation and purity of Solvay Potassium Carbonate is acknowledged throughout the industry. And remember—SOLVAY *alone* produces a *dustless* calcined product!

FOR HIGH GRADE GLASS *Buy High Grade*

POTASSIUM CARBONATE

By SOLVAY

EXCLUSIVE!
Dustless Calcined
Potassium Carbonate
99-100% K_2CO_3

Granular Hydrated
Potassium Carbonate
83-85% K_2CO_3

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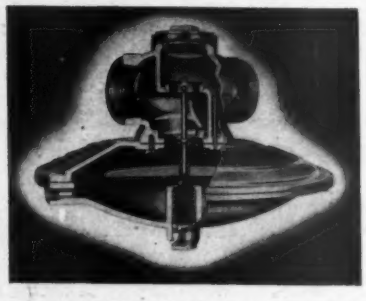
NEW EQUIPMENT AND SUPPLIES

NEW SOFT-SEAT ATMOSPHERIC REGULATOR

North American Manufacturing Co., 4455 East 71st Street, Cleveland 5, Ohio, has developed a new soft-seat atmospheric regulator which should be of interest to furnace engineers and users of low pressure gas in the industrial heating field.

Known as the Series 18 Soft-seat Atmospheric Regulator, it features tight shutoff when the demand for gas flow ceases by incorporating a soft synthetic rubberized fabric facing on the regulator valve head. Users will find the tight shutoff feature quite advantageous in that close control can be realized at low gas flow.



The regulator furnishes gas at atmospheric pressure and requires as a supply gas pressure of from 2 to 16 ounces. Although it was designed, as indicated by its name, especially for supplying atmospheric gas to premix systems, single valve control also can be had with nozzle-mix systems by connecting the vent on the regulator into the line supplying air to the burner on the downstream side of the control valve. The regulator responds quickly to very slight changes in impulse line pressure. Both premix and nozzle-mix systems are assured proportional air-gas ratios over the entire regulator capacity range.

Made in sizes ¾", 1", 1¼", 1½", 2", 2½" and 3", Series 18 Atmospheric Regulators have capacities ranging up to 16,000 cubic feet of natural gas per hour of 19,000 cfh. mfd. gas. According to the manufacturer, shipments can be made from stock.

TEMPERATURE-CALIBRATED POTENTIOMETERS

Rubicon Company, 3606 Ridge Avenue, Philadelphia 32, Pa., has announced a new series of direct-reading temperature-calibrated potentiometers for use in laboratory, plant and field. Ten standard catalog models calibrated over a wide range of temperature for use with copper-constantan, iron-constantan or chromel-alumel thermocouples are available. Special ranges can be supplied when required. Calibration may be had in either Centigrade or Fahrenheit degrees.

Four models are available with Rubicon high-sensitivity multiple-reflection "pointerlite" galvanometers affording substantial improvement in sensitivity over that previously available on low temperature ranges. Accuracy in keeping with the high sensitivity is assured by special structural features which maintain the thermocouple reference-junction and the automatic reference-junction compensator at substantially equal temperatures, irrespective of changes in the ambient temperature.

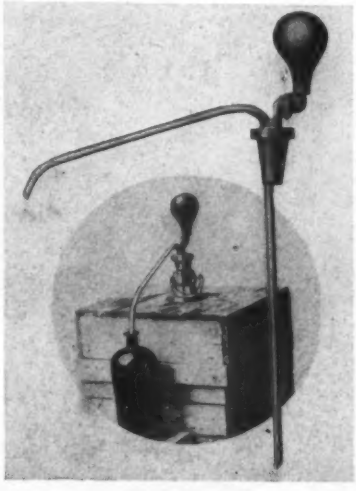
ABSOLUTE PRESSURE GAUGE

United States Gauge Division, American Machine and Metals, Inc., Sellersville, Pa., has developed a new, accurate absolute pressure gauge designed to indicate on a dial, in units of inches or millimeters of mercury, the absolute pressure or vacuum to be measured. The graduations on the dial are the same as used on barometers to accurately measure atmospheric pressure.

The gauge can be built in a number of ranges to suit specific requirements and is frequently furnished with a dial graduated to one complete turn of the pointer. The case is of black molded phenolic material which resists corrosion permitting the gauge to be used in highly contaminated or corrosive atmospheres of chemical process plants and similar places.

PNEUMATIC ACID PUMPS

General Scientific Equipment Company, 27th & Huntingdon Streets, Philadelphia 32, Pa., is supplying a manually-operated acid pump which, according to the announcement, is finding wide usage wherever liquid must be removed from a carboy, drum or barrel.



Corrosive and other liquids flow smoothly and stop instantly; they come in contact only with the corrosion-resistant tube and cannot affect other parts. When the pump is removed, acid drains completely. No tilting of the container is necessary and danger of a slip, a splash or a spill is minimized.

The pumps are supplied in hand- or foot-operated models. Either can be equipped with a lead tube for sulphuric, hydrochloric, hydrofluoric and similar acids or with a Saran (flexible plastic) tube for nitric, phosphoric, acetic acids, peroxide and many other liquids.

NEW ELECTRONIC CONTROLLER

Illinois Testing Laboratories, Inc., 420 North LaSalle Street, Chicago 10, Illinois, has announced the delevopment of a new Electronic Pyrometer Controller for electronic heat control of furnaces, melting pots, kilns or any heating device using electricity, gas or oil.

The Alnor Controller is a precise instrument for both production or laboratory operations. Pyrometer movement is double-pivoted on jewelled bearings. The 6-inch mirrored scale is easy to read and the cast is dust-tight and weather-proof. Ruby "eye" indicates "on" and "off" conditions of heat supply.

CATALOGUES RECEIVED

National Airoil Burner Company, 1284 East Sedgley Ave., Philadelphia 34, Pa., has issued Bulletin No. 40 featuring its fuel oil pumping and heating units.

The 16-page bulletin illustrates various units with descriptive material and capacities for each. Specifications for standard units are given, together with rating and specification tables. A diagrammatic view of a fuel oil pumping and heating unit is also given. Additional tables of general information are shown with illustrations and descriptive matter regarding other National Airoil Burner Company products.

United States Hoffman Machinery Corporation, Air Appliance Division, 105 Fourth Avenue, New York 3, New York, is circulating a new 12-page Booklet A-650 describing many applications of Hoffman blowers and exhausters on production operations which require air pressure from one to eight pounds per square inch on vacuum from two to 11½ inches of mercury.

Design features are explained graphically and operating characteristics and advantages are described. The booklet includes charts showing capacity ranges, as well as a "Handy Data" page of tables, conversion factors and graphs to aid in determining blower or exhauster requirements.

THIS CORHART* BOTTOM HAS RUN FOR 3107 DAYS!

The Corhart* Standard Electrocast refining-end bottom shown above is now in its *sixth* campaign — on July 4, 1947, had finished 3107 operating days on flint bottle glass, and was still going strong!

The Corhart bottom blocks were originally 12" thick, insulated with 6" clay blocks.

Incidentally, the refining-end sidewalls are also the original Corhart Standard blocks that were installed six fires ago!

Here are the figures:

Campaign No. 1 — Aug. 29, '38 to Jan. 14, '40
Campaign No. 2 — Feb. 7, '40 to May 29, '41
Campaign No. 3 — June 23, '41 to Aug. 8, '42
Campaign No. 4 — Sept. 3, '42 to May 14, '44
Campaign No. 5 — June 15, '44 to Mar. 2, '47
Campaign No. 6 — Apr. 2, '47 to ????

This nine-year-old refining end furnishes convincing evidence that Corhart Electrocast produces maximum returns per refractory dollar.

Corhart Refractories Company, *Incorporated,* Sixteenth and Lee Streets, Louisville 10, Kentucky. . . . In Europe: L'Electro Refractaire, Paris.

*Registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

STATUS OF CANADIAN GLASS INDUSTRY

The External Trade Branch of the Department of Trade and Commerce has reported that the Canadian Government's records show that, in the first eight months of 1947 ended August, Canada's exports of common colorless window glass found its largest market in The Netherlands where 767,601 square feet of such glass was shipped for a value of $93,202 out of total exports in that period to all sources of 1,049,514 square feet worth $139,234.

Other glass and glassware exports by Canadian manufacturers in that period totalled $617,336 and the significant disclosure of these shipments is that the Canadian manufacturers endeavored to send all the glass and glassware that they could spare to as many countries as possible, even if the quantities involved were not large in individual cases at this time, with the obvious plan being to send "token" shipments as soon as possible to build up trade in these foreign markets. This was part of an over-all plan to create a large outside market for Canadian glass production in face of shortages in the home market.

Sixty-six countries in every section of the world received such glass shipments so far in 1947, including even the United States where the Canadian glass industry shipped $15,648 worth of glass and glassware and $2,876 of glass lenses, rough and finished. Some of the largest shipments in this period included $76,194 to the Union of South Africa, $69,866 to Sweden, $68,365 to Brazil, and $60,527 to Trinidad, with these typical shipments being mentioned to emphasize the wide field that is being covered by the glass industry in its determined drive for as many outside markets as possible as part of its greatly expanded program in this postwar period.

It is evident that the Canadian glass industry intends to push its export in foreign markets to a greater extent later when production can be increased and the home market satisfied fully, offering stiff competition to the United States and other countries.

The wholesale prices of glass and its products in Canada stood at 108.7 in September as against 104.4 in September a year ago, on the base of 1926 at 100, according to the Prices Branch of the Bureau of Statistics.

The aggregate weekly payroll in the glass and products manufacturing industry of Canada amounted to $791,190 at Sept. 1, 1947, and the average weekly earnings in this industry rose to $37.34 at Sept. 1, 1947, compared with $37.32 at Aug. 1, 1947, or $31.82 at Sept. 1, 1946, according to the Employment and Payroll Branch of the Canadian Government.

Employment in this Canadian industry stood at 140 at Sept. 1, 1947, at 143.7 at Aug. 1, 1947, and 123 at Sept. 1, 1946, and payrolls at 210.3, 215.7, and 157 at Sept. 1, 1947, Aug. 1, 1947, and Sept. 1, 1946, respectively, on the base of June 1, 1941, being 100 per cent.

Canada's imports of glass and glassware continued to climb up during 1947, rising from $1,739,000 in August, 1946, to $1,804,000 in August, 1947, according to the External Trade Branch of the Department of Trade and Commerce.

Likewise, this official report shows that such imports during the first eight months of 1947 ended August have amounted to $20,021,000 as compared with $13,767,000 in the same period of last year.

BALL BROTHERS EXPANSION

An expansion of production lines which will more than triple facilities for fusing colored glass labels to beverage, household, chemical and pharmaceutical bottles has been announced by Ball Brothers Company.

Applied color label facilities already have been increased at the company's plants in Muncie, Indiana, and at Wichita Falls, Texas. Additional ACL lines are being installed now at Muncie and will be ready to go into operation around January 1, according to the announcement.

W. M. LEE JOINS PENNSALT

William M. Lee has joined the Research and Development Department of the Pennsylvania Salt Manufacturing Company as Supervisor of the Special Products Division.

Mr. Lee has formerly been associated with the Sharples Chemical Company, Arabol Manufacturing Company and, in 1942, the War Department invited him to become Chief of the Chemicals and Plastics Section of the office of the Quartermaster General.

C. D. CLAWSON NAMED P.E.I. PRESIDENT

C. D. Clawson, President of Ferro Enamel Corporation, was named President of the Porcelain Enamel Institute at the Institute's recent sixteenth annual meeting. Mr. Clawson replaces Richard H. Turk, Vice President of Pemco Corporation.

Before joining Ferro Enamel Corporation in 1930, Mr. Clawson was associated with A-B Stoves, Inc., Republic Metalware and Chicago Vitreous Enamel Product Company. In 1935, he went to South America to help build and begin the operation of Ferro's two subsidiary plants there and, during the war, he was in charge of the company's war-effort activities.

NEW VACUUM TUBE DESIGN

A new vacuum tube design for use on high voltages at altitudes up to 60,000 feet has been announced by Amperex Electronic Corporation. The development work was sponsored by the Air Material Command of the U. S. Army Air Forces and the tube is especially important in control circuits of guided missiles.

The base of the tube is of glass and is tapered and ground to fit the socket like a glass bottle stopper. This construction excludes all air which, at high altitude, causes flash-over between terminals.

The tube socket is the exact counterpart of the tube, in so far as the taper is concerned. Taper angle is chosen large enough to avoid trapping of air when the tube is plugged into the socket. This design keeps the air exit open until the bottom of the tube reaches the bottom of the socket.

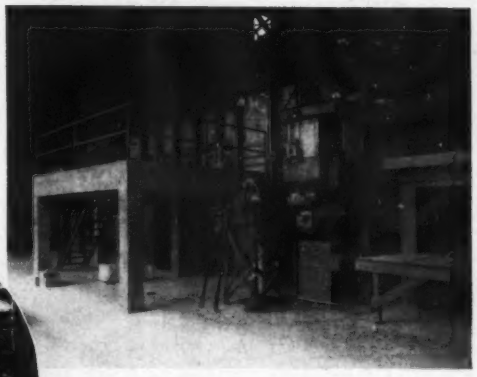
The socket is made of Mycalex because it is a bonded glass-mica composition which will not carbonize in the event of an electrical breakdown. Mycalex is also impervious to moisture, retains its dimensions under extreme conditions of temperature and can be molded to very close tolerances.

When EXPERT consults EXPERT

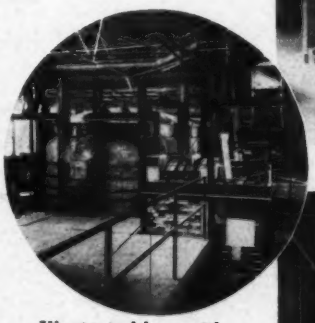
on matters pertaining to glass plants . . .

TECO engineers are often on the scene!

Repeatedly in the past and on numerous recent occasions, the call for TECO experts goes out from the many diversified glass plants throughout the world.



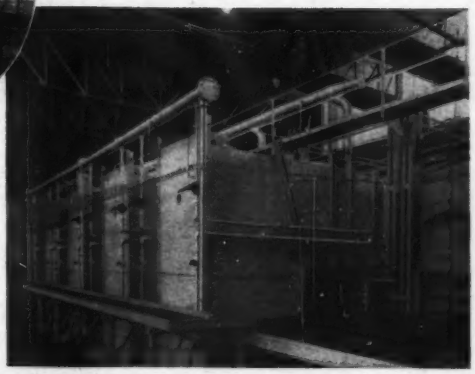
Staffed by long qualified experts in the respective fields of glass container, cooking ware, insulating material and plate glass manufacturing, these plants have found it profitable to look to TECO for wise counsel on:



Illustrated herewith are three typical TECO installations.

(1) Modernization or single unit replacement to improve production methods.

(2) Designing of complete glass plants to effect the proper coordination of the most advanced equipment with modern methods.



(3) Increasing plant output and improving product quality, with resultant lowering in maintenance and production costs.

TOLEDO ENGINEERING Company

GLASS MELTING *and* MANUFACTURING EQUIPMENT

EASTERN OFFICE 220 E. LEXINGTON ST. BALTIMORE MD. • • • 958 Wall St. TOLEDO, O.

W. C. HACKLER JOINS STAFF OF NORTH CAROLINA STATE COLLEGE

The Ceramic Engineering Department of North Carolina State College has announced the appointment of William C. Hackler to the teaching staff.

Mr. Hackler graduated from Virginia Polytechnic Institute with the Bachelor of Science degree in Ceramic Engineering in 1943. Immediately on graduation, he was called into the Army. During the war he served with the 104th Infantry Division in Germany and was separated in 1946 in the rank of Captain.

During the academic year 1946-47, Mr. Hackler returned to V. P. I. on a research fellowship. As a result of this work Mr. Hackler completed the requirements for the Master of Science degree.

SYLVANIA ELECTRIC EXPANDS COMMERCIAL ENGINEERING

B. K. Wickstrum, General Sales Manager of the Lighting Division, has announced that the Commercial Engineering Department of Sylvania Electric Products Inc. has been enlarged and will now include activities of the company's Lighting Center in New York.

Don P. Caverly, Director of the Center, has been named Manager of the expanded Commercial Engineering Department, succeeding Harris Reinhardt, who was appointed assistant to the Director of Industrial Relations.

In addition to his new responsibilities, Mr. Caverly, with headquarters in New York, will continue to direct activities of the Lighting Center and has named J. C. Kromhout, architectural engineer, as Supervisor.

NEW EISLER TYPE AMPULE EVACUATING AND SEALING-OFF MACHINE

Eisler Engineering Co., Inc., Newark, New Jersey, has announced the latest development of an evacuating and sealing-off machine for ampules or glass vials, filled with a dose of medical powder or fluid solution. This machine was designed to improve and simplify pharmaceutical processing on a volume basis.

The complete assembly is mounted on a sturdy steel fabricated square table structure. A barrel cam indexing and driving mechanism transfers an intermittent motion to the turret, that carries a water-cooled circular manifold, equipped with compression rubber chucks, into which the exhaust tubes of the ampules are successfully inserted by the operator. During the subsequent travel through the gas or electrically heated oven each ampule is preliminary evacuated and automatically checked for air leaks by a leak detector with bell signaling device. Defective ampules are isolated by actuating a push lever.

The most important part of the machine, enabling its automatic function, is the Eisler Disc-Valve, consisting of two discs made of special alloy steel carefully heat treated, and accurately ground and lapped. This Disc-Valve is placed between the vacuum pumps and the heads of the machine but makes connection by means of manifolds and pipes, only when the coinciding openings in both discs are permitting it.

The machine can also readily be adapted for the manufacture of telephone switchboard lamps and similar glass work.

Specially Designed to Handle

PLATE GLASS

The Jumbo ROL-AWAY

The larger size, larger capacity of Rol-Away's new Jumbo model is a natural for working with extra-large office and store window glass. Nationally known glass companies such as Pittsburgh Plate Glass Company and W. C. Fuller and Company find that Rol-Away eliminates breakage and saves valuable manhours. This easy-to-operate Jumbo aluminum truck enables one man to handle materials which formerly required a whole crew.

Specially Designed for Handling

LARGE SIZE PLATE GLASS

DIMENSIONS—74" high, 72" long, 36" wide

CAPACITY—3,000 pounds

LIGHTWEIGHT—130 pounds

FASTER—rolls in any direction; saves loading and unloading

SAFE—operator is protected; no slipping or tipping.

NO LIFTING—one man can load with ease; the leverage of Rol-Away does the job.

SAVES SPACE—loads are carried and stored on end; takes less floor space.

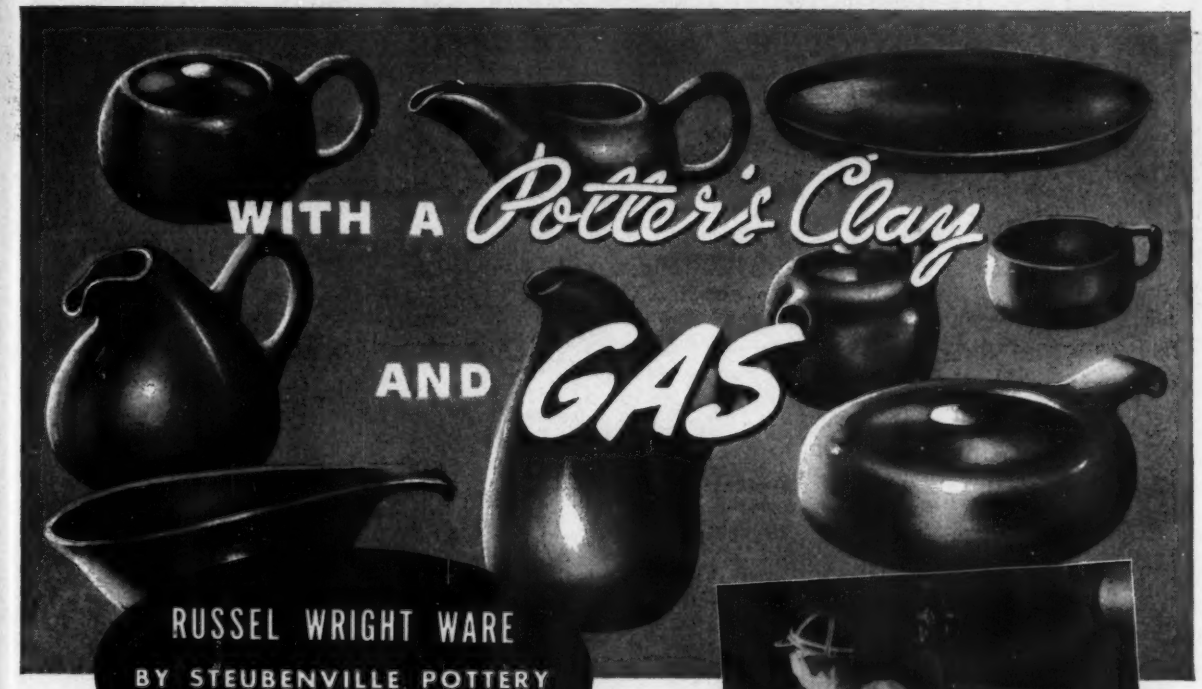
The ROL-AWAY

DEALER FRANCHISES AVAILABLE

BEALL PIPE & TANK CORP.

1945 N. COLUMBIA BLVD., PORTLAND 3, OREGON

Send for Details and Prices Direct



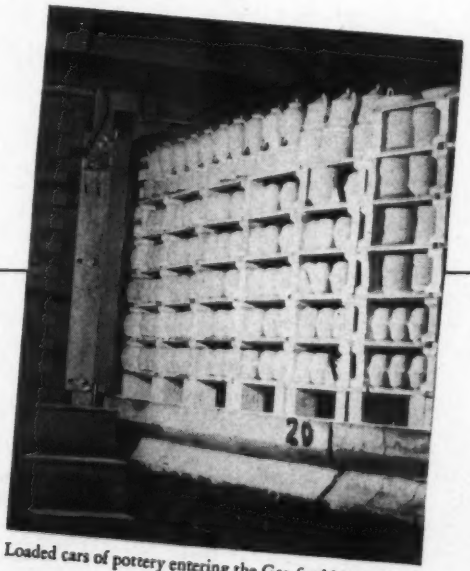
RUSSEL WRIGHT WARE
BY STEUBENVILLE POTTERY COMPANY
Steubenville, Ohio

True—this fine pottery contains chemicals and coloring, includes other ingredients, but at Steubenville Potteries GAS is the production-line fuel for continuous cycle heating operations, is just as important as the potter's clay in fine ceramic manufacturing.

This busy pottery furnishes many examples of the flexibility of modern Gas-fired Equipment, and the precise controllability of GAS. In decorative bonding, bisque firing, glost tunnel heating, radiant and convection drying, finishing operations, automatic controls maintain the exact temperatures for streamlined ceramic productioneering.

From basic materials to finished products, GAS is the ideal fuel for all heating operations in the ceramic and glass industries. The successful application of GAS and modern Gas-fired Equipment at Steubenville Potteries typifies the results you can expect when you call in the Representative of your local Gas Company for consultation.

Gas-fired continuous dryer,—the conveyor belt is loaded at this end.



Loaded cars of pottery entering the Gas-fired bisque kiln.

AMERICAN GAS ASSOCIATION
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MORE AND MORE...
THE TREND IS TO GAS
FOR ALL CERAMIC FIRING

EFFECT OF COLORING OXIDE ON SPECTRAL TRANSMISSION OF A SODA-LIME-SILICA GLASS . . .

(*Continued from page* 634)

containing 0.50% Cr_2O_3 transmitted no ultraviolet radiation. V_2O_5 is the second best absorber of ultraviolet radiation.

Glasses containing Nd_2O_3, Pr_6O_{11}, Sm_2O_3, V_2O_5, and U_2O_3 have a relatively high over-all transmission.

The glasses obeyed Beer's law[13] fairly well in the visible region. For purposes of comparison, the measurements should be made at the lowest point of the absorption band, but in several cases there were no minima in the visible region to be used in this manner. This fact may explain in part the deviations from the law that were encountered.

An examination of the transmission curves reveals that in some instances the curves intersect one another, so that at some wave lengths the glass containing a larger percentage of the coloring oxide transmits better than the one with a smaller percentage. The cause of this effect is not known with certainty. It may be conjectured, however, that in the neighborhood of the water band the fact that the water content was not controlled may cause some variation in the transmission. At shorter wave lengths, a change in oxidation of the colorant would have a similar effect.

Abstract

The effect on spectral transmission—ultraviolet, visible, and infrared—of the addition of coloring oxides to a soda-lime-silica glass is investigated. The results are presented in graphical form. The transmission data are corrected for reflection losses. The absorption bands fall into three classifications: (a) A band at 3.5 to 4.0 microns due to the structure of the glass itself, (b) a band at about 2.9 microns, due to the water content of the glass, and (c) absorption bands at wave lengths shorter than about 2.6 microns, due to the absorption of energy by certain electrons in the atoms of the coloring oxide. Co_3O_4, Ni_2O_3, and Fe_2O_3 additions are the most effective absorbers of infrared radiation. Cr_2O_3 and V_2O_5 additions are the most effective absorbers of ultraviolet radiation.

The infrared transmission spectra of powdered silicate glasses prepared by melting crystals are examined in an endeavor to cast some light on the structure of glasses. It is concluded that glasses of the same chemical composition may be somewhat different in structure, and that when a glass is made by the melting of a crystal, the structure of the glass may have some relation to that of the parent crystal.

Acknowledgment

The author expresses his appreciation to Dr. F. V. Tooley, Professor of Glass Technology, and to Dr. A. I. Andrews, Head of the Department of Ceramic Engineering, for their valued suggestions, interest in, and general supervision of this research.

Grateful acknowledgment is made also to Dr. Scott Anderson of the Anderson Physical Laboratory, Champaign, Illinois, for permission to use his infrared spectrometer and for his valued suggestions, to Professor D. T. Englis of the Department of Chemistry, University of Illinois, for permission to use the Beckman spectrophotometer, and to Professor J. O. Kraehenbuehl of the Department of Electrical Engineering, University of Illinois, for the running of the Hardy-General Electric recording spectrophotometer.

[13]Wallace R. Brode, Chemical Spectroscopy, p. 151. John Wiley & Sons, Inc., New York, 1943. 677 pp.

CORNING AND UNION SIGN WAGE CONTRACTS

Under terms of wage contracts signed at the main plant of Corning Glass Works recently, production and maintenance employees of the company's Corning, New York, and Wellsboro, Pa., plants will receive wage increases of 8 cents per hour, or 6 per cent, whichever is greater, it was announced by Harry M. Hosier, Vice President and director of Corning's industrial relations. The increase is effective October 20, 1947, and involves members of the American Flint Glass Workers' Union-AFL, Local 1000 in Corning and Local 1001 in Wellsboro.

In addition to the general wage increase, two other major changes are included in the new contracts. The first of these concerns non-rotating shifts beginning at 10 p.m., 11 p.m. and midnight, which now will receive a shift differential of 10 cents per hour. The second change provides that employees shall be paid their base rate for the Thanksgiving and Christmas holidays, even though they do not work these days. In the event either or both of the holidays are worked, employees shall receive double time.

NATIONAL CHEMICAL EXPOSITION SET FOR 1948

The date for the Fifth National Chemical Exposition by the Chicago Section of the American Chemical Society has been set for October 12 through 16, 1948, at the Chicago Coliseum.

Mr. Marcus W. Hinson has been engaged again to manage the details of the Exposition.

COLORADO FUEL APPOINTS GENERAL MANAGER OF SALES

The appointment of H. C. Allington as General Manager of Sales of the Wickwire Spencer Steel Division with offices in New York City has been announced by The Colorado Fuel and Iron Corporation.

Mr. Allington has formerly been associated with Sharpsville Boiler Works and American Machine and Metals, Inc., and joined Wickwire Spencer Steel Company in 1943. He joined the company to manage a new products department but was selected Assistant General Sales Manager shortly after. He has filled this position until his present appointment.

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INVENTIONS AND INVENTORS . . .
(*Continued from page* 639)

a trough 2 in a chamber 3 formed by walls 4 and 5. The glass flows downwardly through an opening 7 around a shaping element 11 from which it passes to a suitable handling mechanism. A shaping chamber 6 has below it, an auxiliary shaping chamber 12 including a block 14 carried by a framework 15. Burners 20 are positioned below to heat the tube as may be desired. A glass shaping element 11 is formed of electrically heated wires which taper downwardly.

The block 10 is supported on a blow pipe 30 which blows air into the tube being formed. The upper end of the pipe 30 is arranged to be rotated by a pulley 40 driven by a belt 41. By this construction, glass tubing of high quality may be produced at high speed and at lower cost.

The following references are of record in the file of this patent: United States Patents: 1,631,805, Ferngren, June 7, 1927; 2,212,448, Modigliani, Aug. 20, 1940; 2,225,369, Danner, Dec. 17, 1940; 1,631,061, Rankin, May 31, 1927; 2,181,030, Thomas, Nov. 21, 1939; and 2,215,982, Slayter et al., Sept. 24, 1940. Foreign Patents: 834,467, France, Oct. 16, 1938.

Method of Cleaning Glass. Patent No. 2,428,443. This invention relates to the cleaning of highly polished surfaces such as those used in optical instruments. It is the invention of William Whitehead of Rye, N. Y., who assigned it to Celanese Corporation.

The importance of perfectly clean glass surfaces in delicate optical instruments is well known. Various materials have been proposed for wiping but these not only shed lint but the fibers are difficult to remove on account of the static charge of electricity produced by the rubbing.

This inventor has discovered that optical surfaces may be thoroughly cleaned by the use of a textile fabric comprising continuous filament yarns of regenerated cellulose. Such yarns are prepared by the complete saponification of yarns having a basis of an ester of cellulose. The manufacture and saponification of this material may be carried out by methods well known to the trade. The resulting material is highly absorbent and leaves the glass at practically zero electrical potential which prevents picking up lint and dust.

The following references are of record in the file of this patent: United States Patents: 2,046,615, Dreyfus, July 7, 1936; 2,193,894, Whitehead, Mar. 19, 1940; 2,150,569, Whitehead, Mar. 14, 1939; 2,053,766, Dreyfus, Sept. 8, 1936; 2,142,716, Dreyfus et al., Jan. 3, 1939; 2,142,717, Dreyfus et al., Jan. 3, 1939; 2,142,721, Dreyfus et al., Jan. 3, 1939; 1,314,116, Baillie, Aug. 26, 1919; and 1,886,824, McCormick, Nov. 8, 1932.

Corhart Refractory Mortar. Patent No. 2,429,872. This patent was assigned to Corhart Refractories Company by William R. Downs of Louisville, Ky. While the patent is directed particularly to use in the electrolytic production of magnesium, it can well be used in the manufacture of other material.

The temperature of the molten bath is between 700 and 800° C., and the mortar for this purpose must have good working properties, it must develop a cold strength quickly, and must mature at a temperature no higher than the normal operation of the cell. Strength, long life and other properties are also necessary. This mortar contains highly refractory grains, each grain comprising highly aluminous glass pre-bonded to refractory crystals, fines of a binder maturing at the operating temperature of the mortar, and an alkali fluoride reacting at maturing temperature with the binder. The most desirable glass has been found to be a borate glass such as one of the B glasses disclosed in the Sullivan & Taylor Patent No. 1,304,623.

The patent gives complete directions for carrying out the invention and three examples of batches which have been found satisfactory. One of these batches is as follows:

		Parts
(1)	Refractory mixture consisting of:	
	Corundum-mullite-glass grains ..... 126 parts	
	Milled zircon ..... 14 parts	140
(2)	Na_2SiO in water (38° Bé.)	60
(3)	Na_2SiF_6	4
(4)	Glass fines as above	60
(5)	NaF	10

(*Continued on page* 656)

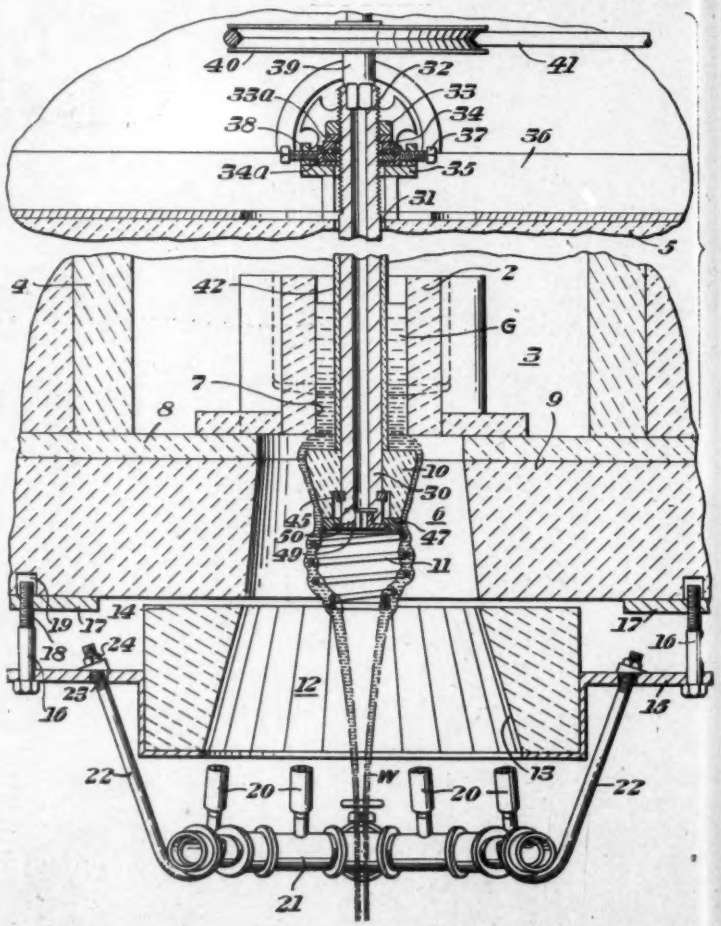
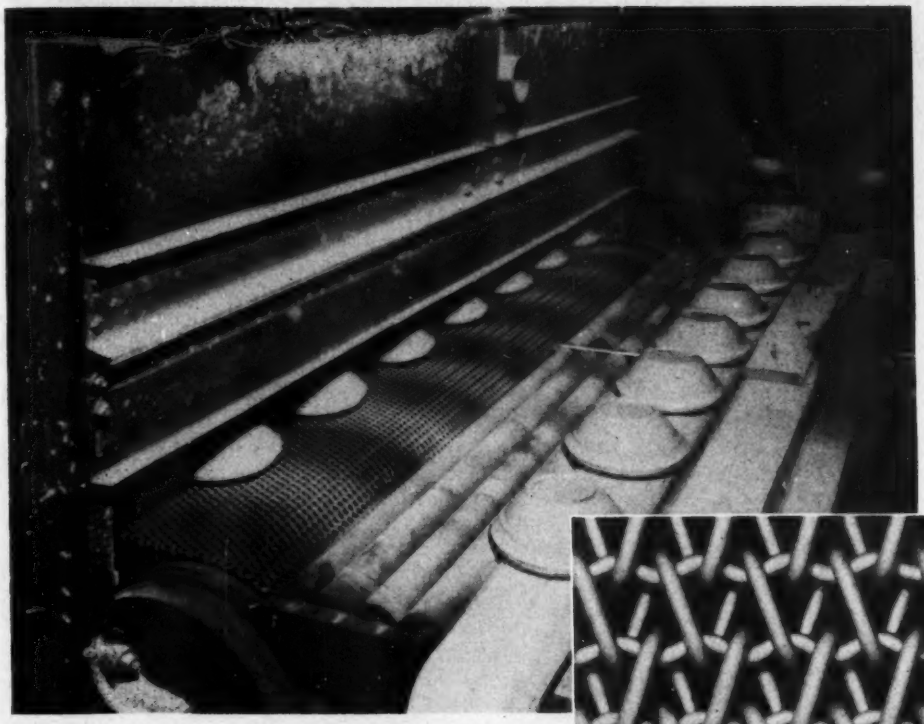
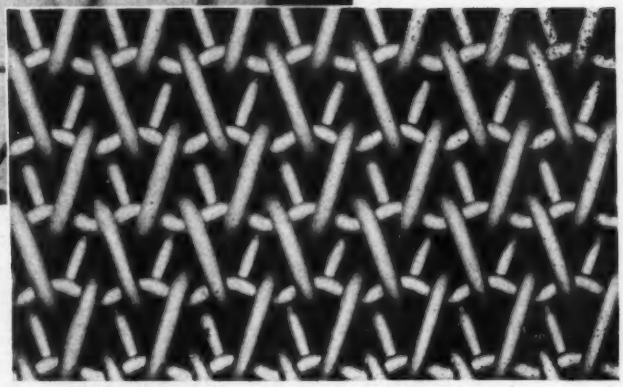


Fig. 6. Glass Tubing Machine.





Pottery processes *speeded up* . . . costs *slashed* through

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. . . This illustrated technical handbook is a complete, practical reference for all belt users. Write Dept. 15 for your copy.

INFRA-RED DRYING on CAMBRIDGE BALANCED BELTING

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CAMBRIDGE WIRE CLOTH CO.
CAMBRIDGE, MARYLAND
Boston · New York · Baltimore · Pittsburgh · Detroit · Chicago · San Francisco · New Orleans · St. Louis

INVENTIONS AND INVENTORS . . .

(*Continued from page* 654)

The following references are of record in the file of this patent: United States Patents: 1,867,444, Dietz et al., July 12, 1932; 1,883,675, Frank et al., Oct. 18, 1932; 1,973,731, Snell, Sept. 18, 1934; 1,973,732, Snell, Sept. 18, 1934; 2,065,389, Mohrle, Dec. 22, 1936; 2,240,393, Dietz, Apr. 29, 1941; 2,195,949, Wood, Apr. 2, 1940; and 2,195,950, Wood, Apr. 2, 1940. Foreign Patents: 517,672, Great Britain, 1940; 849,016, France, 1939; 568,538, Germany, 1933; 575,240, Germany, 1933; 702,739, Germany, 1941; and 807,615, France, 1936.

PITTSBURGH PLATE NAMES SUPERINTENDENT ASSISTANT

The appointment of Thomas G. Wright as assistant to the general superintendent has been announced by the Pittsburgh Plate Glass Company.

Associated with the firm since 1930, Mr. Wright has served at the Creighton, Pa., plant as Duplate plant engineer and as production supervisor. During the past ten years, he has been assistant plant superintendent.

It was announced that Paul C. Lawson will succeed Mr. Wright as assistant superintendent of the Creighton plant. Mr. Lawson joined the company in 1931 in the engineering development section at the Creighton Duplate department. He was appointed general foreman of the assembling and pressing department in 1938 and Duplate plant supervisor in 1942. He has served as production manager since October 1946.

GLASS EXHIBIT TO BE HELD

An exhibition of glass, the first of its kind in recent years, will be held at the Cooper Union Museum in New York, January 12 through March 20, Calvin S. Hathaway, Curator, has announced. The exhibition will sum up the developments in glass design and manufacture since 1925 with examples of the latest and best in both decorative and utilitarian glass.

The principal division of the exhibition will be devoted to glass in its use as a decorative art. It will be a survey of decorative glass, including objects of daily use, produced during the past 25 years, and will feature both American and European examples, ranging from unique hand-blown pieces to those in the production of which machines have played a more or less important part. Many of the examples from European factories will represent the first glass from such sources to reach this country since the war.

An introductory section of the exhibition will be devoted to the technical aspects of glass manufacture and will briefly show how glass is made, shaped and decorated. This section will also include a group of glass objects which will show how glass has come to play an increasingly important role in contemporary civilization. There will be examples of glass textiles, insulation, bricks, packaging, cooking, chemical and electrical ware, etc.

• Purchase of a two-story and basement building by Leeds & Northrup Company, manufacturers of electrical measuring instruments, automatic controls and heat-treating furnaces, has been announced.

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Mix Glass Batches in this Modern Dust-Sealed Mixer
Promote the HEALTH and EFFICIENCY of your employes by mixing glass batches in a modern Smith Tilting Mixer. It's DUST-SEALED during the entire mixing cycle — no chance for dust or vapor to escape. A sealed charging chute and a sealed rectangular shaped discharge "dust boot" confine both dust and vapor within the mixer drum, thereby effectively eliminating the silicosis hazard. The famous Smith duo-cone drum, with its scientific mixing action, insures uniform batches, improved quality of glass and greater production. Backed by 44 years' specialized experience in mixer design and manufacture. Write for Catalog.
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MANY leading manufacturers have shown preference for Pennsalt Hydrofluoric Acid for polishing fine cut glassware. It has proven its dependability by fulfilling the most exacting requirements.

In addition to etching and polishing glassware, Pennsalt HF is valuable in frosting decorative glassware and electric light bulbs, pickling stainless steel, cleaning castings, improving the quality of glass makers' sand and other important industrial raw materials, and in the preparation of fluorine compounds.

Pennsalt HF is available in strengths of 30%, 52%, 60% and 80% for domestic users; 71-75% for export. Strengths above 60% shipped in steel containers, weaker strengths in rubber drums. Write us for full details.

ANHYDROUS HF was first produced commercially in our Easton, Pa., plant. It is used as an alkylation catalyst in production of high octane gasoline. Also used in production of organic fluorine compounds, synthesis of other organic compounds, preparation of high purity inorganic fluorine compounds. Shipped in cylinders and tank cars.

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CHEMICALS

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Eye Droppers, etc.

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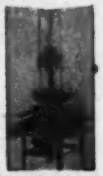
High Production Fully Automatic

Various types of Bulbs & Tubes made by Eisler Glass Machines

High Production Fully Automatic

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GLASS FIBERS, INC., SWINGS INTO FULL PRODUCTION . . .

(*Continued from page* 626)

tronic heaters of this nature always produce the same temperature in the same area and therefore quality of heating output is never in doubt. The heating operation is entirely automatic and the only labor involved is the loading of glass marbles that are passed through the proper channel through the platinum crucible. In the electronic circuit used the current is first stepped up by a transformer to a certain voltage which is then rectified by electronic tubes, after which the oscillator equipment adds its high-frequency effect, oscillating so rapidly it converts the rectifier output ripples into half a million or more complete alterations per second wherein is obtained the needed intense "skin-effect" heat. In every individual panel numerous electronic tubes are employed, each for a definite purpose, assembled with associated standard parts such as transformers, resistors, capacitors, condensers, etc., involving an intricate wiring system which is both automatic and fool-proof.

Glass Fibers, Inc. maintains its own drafting department and fully equipped machine shop where its specially designed equipment is privately tooled and assembled. It has its own assay department, foundry and chemical laboratory, all operating under ideal surroundings of perfect lighting, and sanitary working conditions.

The art of glass making has been known for many years, in fact, many centuries, but not the master-art of making glass of a kind that will form strong, durable and infinitely fine fibers. Expansion of surface area was one problem encountered in the engineer's research which was finally solved. For this and several reasons it was found necessary to discover by patient research special glass formulas and heat producing technique in their progress toward the making of superior glass fibers; possession of resistance to withering chemical action, tensile strength, longer life under severe operating conditions and other influences to which glass fibers might be exposed . . . and finally to produce progressively a better product that could be sold to industrial manufacturers at a progressively lower price. This has been the goal set by the management of Glass Fibers, Inc., an accomplishment which, happily, has now been reached—

A partial view of the electronic control panel which regulates the power used in the heating which produces Vitron glass fibers.

although the horizon of their efforts is to expand and develop their product to even greater perfection.

As an indication of these expansion plans, Glass Fibers, Inc., points to its pilot plant now in operation on a new glass fiber bonded mat material. An addition to the main plant is now under construction, which, when completed (estimated July 1948), will more than double the manufacturing facilities of the company. This addition will house the new bonded mat operation and will employ the same technique now being perfected in the pilot plant operation. Other additions are contemplated to take care of expansion into other forms of glass fiber products based on the same fundamental processes which have proved so successful in the manufacture of Vitron textile yarn.

The personnel of Glass Fibers, Inc., consists of the following officers: R. H. Barnard, President and General Manager; R. R. Bastian, Vice President; F. H. May, Jr., Secretary and Treasurer; Harry O. King, Chairman of the Board; Gordon W. Reed, Chairman of the Executive Committee; Dr. Jess Plummer, Chief Engineer and Director of Research, and Edward Clayton, Electronic Engineer.

FINLAND IN NEED OF SCIENTIFIC LITERATURE

It has recently been learned of the dire need of scientific and technical books and periodicals by the Technical Institute in Finland. This need has been brought about by bombing during the war which completely destroyed the Institute's library.

If there is a reader who may have duplications in his library or who may wish to contribute some technical books or magazines to help rebuild this library, it will be very much appreciated. Such contributions should be marked for the Institute of Technology, Helsinki, and sent to the Legation of Finland, 2144 Wyoming Ave., N.W., Washington, D. C. Arrangements will be made there for sending such contributions to Finland.

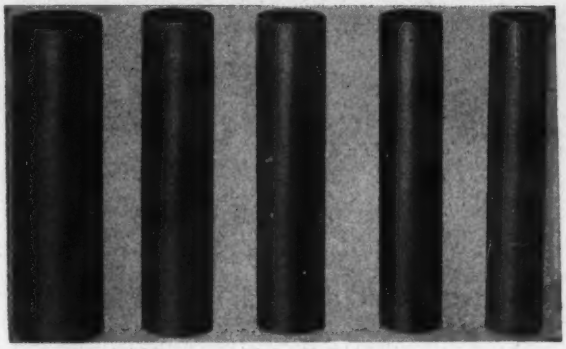
AMERICAN POTASH EXPANSION PROGRAM

American Potash & Chemical Corporation has announced the completion of the first phase of its postwar program calling for an initial expenditure of more than $7,000,000 by the end of 1948.

Already completed on the company's list of major projects are the following undertakings: a new $300,000 research laboratory, a modern office building and a subdivision of 47 homes increasing plant housing facilities. Under construction and scheduled for completion in 1948 are a new $4,500,000 soda ash-borax plant and a $2,000,000 power plant expansion.

Production and earnings of the company in the past two years have kept pace with its rapidly progressing program. In 1946 production and sales rose to an all-time peak. Last August the company reported net earnings of $1,102,056.88 for the six-month period ending June 30, 1947, equivalent to $1.94 per share on outstanding Class A and B common stock (after deduction of $77,777.77 for dividends on "Series A" preferred stock). Gross sales of the company's products amounted to $10,332,328.77 for the first half of this year.

GUNITE



ROUND BAR STOCK

Gunite can be machined with relative ease, yet has a high density that will take a brilliant polish. Round Bar Stock is available in 18 sizes from ¾" to 5" diameter, all bars 14" long. There is a suitable Gunite alloy for many types of glass-making castings such as Plungers, Ring Sticks, Neck Rings, Guide Rings, Moulds, Blanks, Bottom Plates, etc.

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The N & F super-concrete stave is formed under pressure, making it extremely smooth, dense, and durable. Each stave interlocks with six adjacent staves to form strong, tight joints. The structure is securely bound with steel hoops, encircling the staves in tiers.

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NEFF & FRY STORAGE BINS

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Glass Tank Furnaces is the only book in the English language dealing comprehensively with glass tanks. Its contents include and describe in simple language, the most modern practices in design, construction, operation, behavior and economy of glass tanks. It is a book for the factory man, the technologist and for all who are interested in the practical aspects of glass making.

Glass Tank Furnaces contains 105 figures and illustrations—75,000 words typed in two columns and produced by the lithoprint process. Cloth bound, price $4.00. Foreign $4.50, F.O.B:

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Name.....

Company.....

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ANNUAL MEETING OF THE OPTICAL SOCIETY . . .
(*Continued from page* 635)

waves, because of the similarity of many microwave properties to those of visual optics.

At a dinner meeting well managed by Dr. Harrison, whose ready wit kept things lively, Wm. F. Meggers, Ives medal winner, presented a paper on the use of the green line of mercury as a standard of length. He pointed out that in an age of atomic bombs and wars of total destruction it would be possible to destroy the prototypes of our systems of measurements, but that the atomic research had also made possible the production of large quantities of mercury consisting of a single isotope having a spectral line showing no fine structure. This monochromatic light could be used as a unit of length and would be eternal.

NATIONAL SAFETY CONGRESS FORMS GLASS-CERAMICS COMMITTEE

During the National Safety Congress, which was held in Chicago in October, the Glass and Ceramics Committee of the National Safety Council was formed.

Fred G. Anderson, Manager of compensation and safety of Corning Glass Works, was elected Chairman, and H. V. Gardner, Safety Director of Owens-Illinois Glass Company, was named Vice-Chairman of the committee.

Other officers elected were John Stephenson, Safety Director of Ball Brothers Company, as Secretary, and William Hazard, Industrial Relations Division of Owens-Illinois Glass Company, as Chairman of the promotion committee.

The first issue of the Glass and Ceramics Committee newsletter is scheduled for publication in January 1948.

STUDENT BRANCH OF A.C.S. SPONSORS FORUMS

A series of forums on "Jobs in Ceramic Industries" is being sponsored at the New York State College of Ceramics at Alfred University this year by the student branch of the American Ceramic Society.

The monthly sessions, led by men in all branches of the industry, will cover jobs in administration, development, production, research sales. The series is designed to present a cross-section of the industries which ceramic students may enter and to give seniors more specific information about the type of jobs available.

AMERICAN POTASH ADDS TO STAFF

Joseph S. Whittington of North Tarrytown, New York, who has had nearly 30 years' experience in the fertilizer and general chemical business, has joined the American Potash & Chemical Corporation at New York City as Manager of sodium sulphate sales.

Mr. Whittington was Manager of the Norfolk, Virginia, office of the Ashcraft-Wilkinson Company and later opened the New York offices of the Independent Fertilizer Manufacturers' Association, Inc. During recent years, he served as executive Vice President of F. W. Berk & Company, Inc.

G.C.M.I. HOLDS SEMI-ANNUAL MEETING IN MIAMI . . .
(*Continued from page 629*)

consumer. The Committee will continue to issue bulletins and other data to keep the Industry adequately informed regarding this important work."

Labor Relations

The final report to the Board of Trustees of the Institute was that of the Committee on Labor Relations, whose Chairman is Mr. L. C. Roche of the Maryland Glass Corporation.

The complexity of the work of the Labor Committee makes it difficult to review its activities for the period covered by the Committee's report. It can be stated, however, that a great deal of discussion has taken place concerning the effect of the new Labor-Management Relations Act on the relationship which has existed between the management of the glass container companies and the unions which represent their employees. In this connection, Mr. Roche stated that he saw no reason why the new labor law should necessarily create any difficulties in the industry or bring about any radical change in the industry.

• Ernesto J. Aguilar, general representative in Mexico for the Pittsburgh Plate Glass Company, is serving as a member of the Extension Committee of Rotary International, world-wide service organization, for 1947-48. He will remain in office until June 1948. Mr. Aguilar maintains his headquarters in Mexico City.

CLASSIFIED ADVERTISEMENTS

GLASS FACTORY SUPERINTENDENT

Here's an exceptional opportunity for an experienced glass factory man. The man sought is 35 or older, experienced in supervision and control of Hartford I.S. Machine operations. To take full charge and superintend machine operations of a large midwest bottle factory. Your reply held in strict confidence but should embrace all details. Address Box 68, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

PLANT MANAGER WANTED

One of the leading glass manufacturers has an opening in one of its container plants. The man we want must be thoroughly grounded in factory management, have initiative and knowledge to take complete charge of a modern glass container plant and make it produce. The salary is right, future excellent. Write full details in your first letter, in full confidence. Reply Box 69, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

Experienced man to take charge of Selection and Packing Department in modern West Coast glass plant, manufacturers of wide mouth and narrow neck ware. State age and experience. Reply Box 67, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

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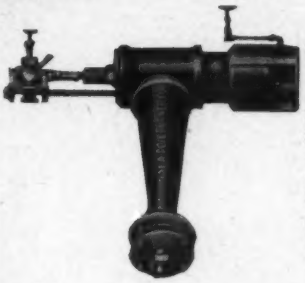

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CORNING STAFFS MUSKOGEE PLANT

Fourteen Main Plant employees are among the Corning Glass Works personnel comprising the supervisory staff of the company's new Muskogee, Oklahoma, plant, who left recently for that city to assume their new duties.

With construction virtually complete, present plans schedule the firing of the plant's melting tank for the first week in December.

Willard L. Porter, formerly supervisor of job evalution at the Corning plant, has been named Production Superintendent for Muskogee. With the company for ten years, Mr. Porter has served as laboratory assistant, as technical production advisor and in the Corning Rate Department.

Supervisor of Industrial Relations for Muskogee is Lloyd W. Larson; Marshall L. Ham is Muskogee plant accountant. Supervisor of Quality Control for Muskogee is H. B. Hilfiger, and Charles L. Myers has been named superintendent of Engineering and Maintenance.

PENNSALT CHANGES NAME OF ACID-PROOF CEMENT

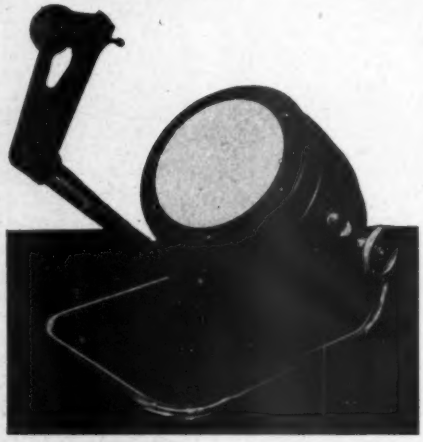
The Pennsylvania Salt Manufacturing Company has announced a change in the name of one of its acid-proof cements.

The product formerly called Asplit F cement has been changed to Pennsalt HF cement. It was explained that the new name is more in conformity with other company named products with the HF part denoting the cement's complete resistance to hydrofluoric acid in all strengths.

RUTGERS GLASS PLANT INSPECTION TRIP

A group of forty students from the School of Ceramics, Rutgers University, conducted by Clarence A. Lambelet, instructor, recently made an inspection trip to the South Jersey glass area, visiting the plants of the Kimble Glass Division of Owens-Illinois Glass Company in Vineland, N. J., and the Armstrong Cork Company in Millville, N. J.

At the Kimble plant, where arrangements were made by J. F. Greene, the students witnessed the manufacture of various types of scientific glassware products. Arrangements were made by R. F. Scott of Armstrong Cork Company for the students to visit this plant.



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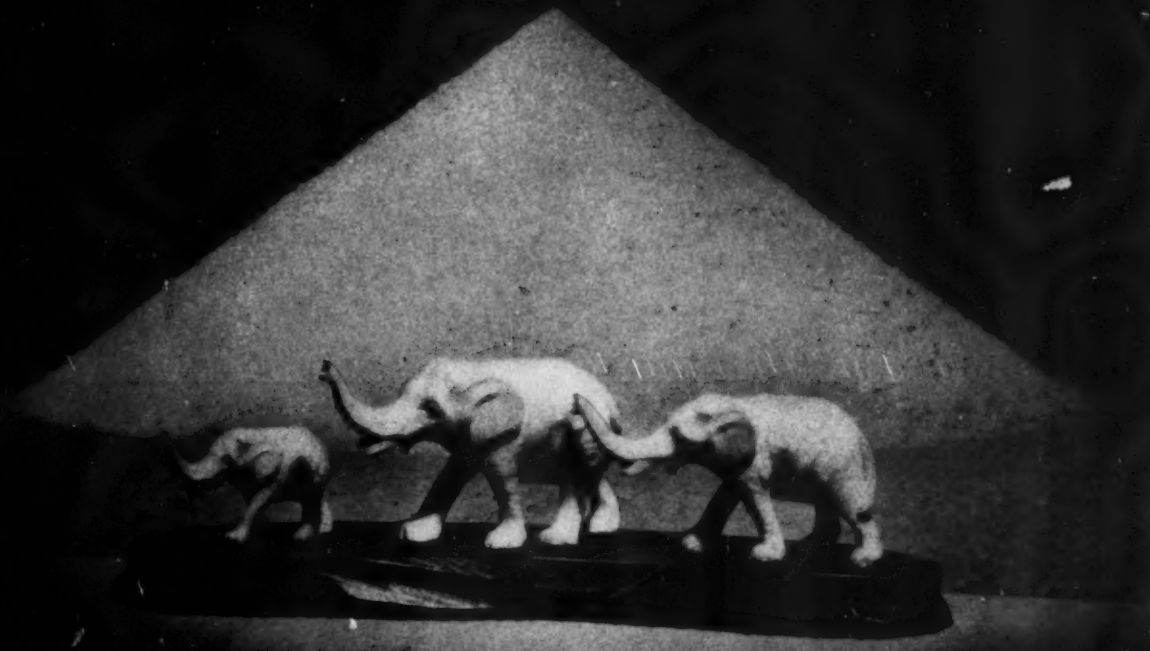

The use of borax in commercial soda-lime-silica glasses has become standard practice during the past few years.

It facilitates the melting process to an extent which is apparent in lower production costs.

In a properly balanced batch, borax will improve the strength, color, brilliancy, thermal properties and durability of your product.

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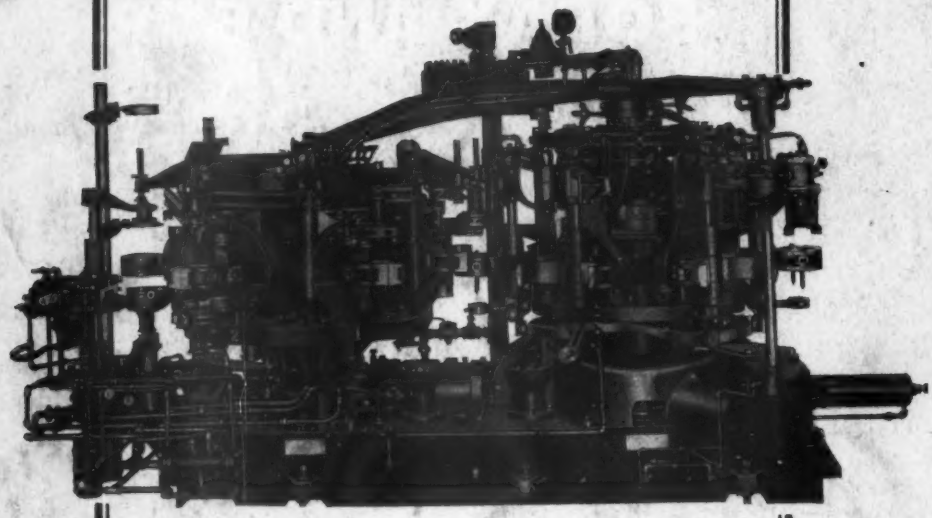

for Narrow Mouth Bottles

The Machine shown here is the Model "10" machine. And while this machine is primarily designed for making narrow mouth bottles, it is suitable for the production of wide mouth glass containers also.

For complete details, write for folder on this and other models manufactured by the Lynch Corporation.

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